

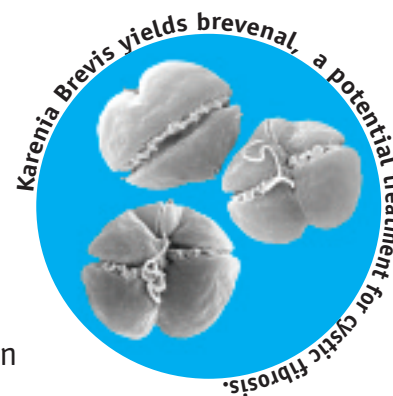
FEATURE ARTICLE

# MARBIONC: New Wave Science

By Jeffrey Wright, Ph.D.

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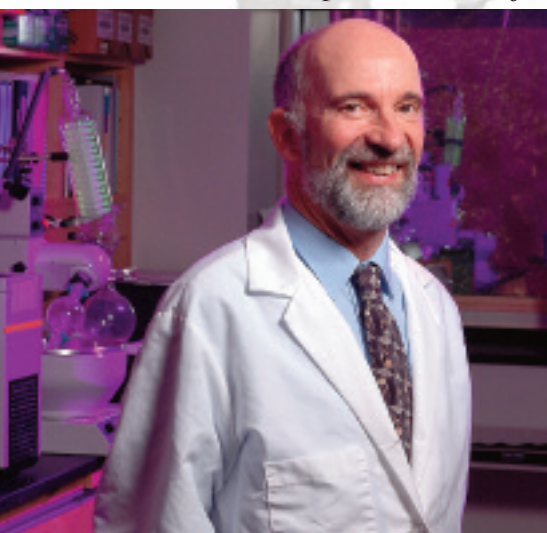
– Jeffrey Wright, principal and director of research, MARBIONC



**The Egyptians are recognized** for the first biotechnology applications. They used yeast to bake bread and fermented yeast and hops to brew beer. What is perhaps less well known is that the first marine biotechnology product was developed by the Phoenicians thousands of years ago. They took the ink squirted by mollusks as a defense mechanism to avoid predators and used it as a dye to color fabric. From this dye, called Tyrian Purple, dye makers produced robes with a beautiful purple color. These robes were much sought after by the wealthy – so perhaps we might refer to them as Phoenician “bling.” Even today the dye is still used and is often referred to as “royal purple.”

## THE NEW WAVE

Almost half of today’s pharmaceuticals are natural products or based on natural products. We recognize names such as penicillin, tetracycline, digoxin, taxol,



**Dr. Jeffrey Wright is a principal and director of research at MARBIONC, a part of UNC Wilmington’s Center for Marine Sciences.**

lovastatin and there are many more. What do the oceans have to offer as sources of new drugs? Certainly the potential seems enormous – over 70 percent of the planet is covered by ocean. It is well known that the biodiversity of the oceans is far greater than on land.

Another marine biotechnology product is carageenan, a polysaccharide obtained

from certain species of red seaweeds, which is used as a stiffening agent in many of our everyday products such as toothpaste, ice cream, instant puddings, jelly-making and shampoo.

Another more modern application is the discovery of pseudopterosin, an anti-inflammatory product, from gorgonians, a type of Caribbean coral that form into shapes that are called sea whips or sea fans. Pseudopterosin has found great success as a high-end skin care product offered by a renowned cosmetics company.

The discovery in the early 1950s of two unusual nucleosides named spongothymidine and spongouridine from a coral reef sponge in the Caribbean led to the development of two drugs Ara A and AZT (antiviral) and Ara C (anticancer), which are still used today as therapeutics. In fact these two unusual nucleosides, with their potent biological activity, led to the synthesis of many hundreds of analogs, some of which are important antiviral agents. Indeed the discovery of new natural products, with novel structures and potent biological activity, remains a critical element in new drug discovery. Even if the natural product itself is not used, it provides a new target for synthetic and medicinal chemists to develop effective analogs that possess improved potency and specificity.

## SOME CHALLENGES

Despite the early success of Ara A and Ara C, other such discoveries from the ocean were slow to develop. The success of natural products from land-based plants, and the successful fermentation of bacteria and fungi overshadowed the early research on marine natural products. Other impediments included the difficulty of obtaining marine organisms, which often required SCUBA-trained personnel, the challenges of identifying new marine species, particularly sponges, the low yields of compounds from various species and difficulties in collecting sufficient material for chemical and pharmacological studies.

Nevertheless as the need for new chemical structures and biological activity has become more urgent, remarkable progress has been made in the area of marine natural products discovery. Today, the record shows that around two dozen marine natural products or derivatives are in clinical trials for treatment of cancer (e.g. dolastatin 10,


ecteinascidin 743 and aplidin), neuropathic pain (e.g. ziconotide), inflammatory disease (e.g. IPL-512602) and epilepsy (CGX-1007). In some cases, progress has been hindered by the lack of available material.

### MARBIONC'S SOLUTION

One of the activities of the MARBIONC (Marine Biotechnology in North Carolina) program at UNC Wilmington is the discovery of new bioactive compounds from marine organisms of interest to the pharmaceutical industry. To start with, this is achieved by isolating photosynthetic (phytoplankton) and non-photosynthetic (bacteria) microbes from the marine environment and culturing them in the laboratory. From these laboratory cultures new bioactive compounds are found in a team effort that brings together phycologists, microbiologists, chemists, biochemists and pharmacologists. This approach offers two advantages. Because only tiny amounts of samples are required to isolate these microbes, the ecology of an area is not disturbed by the necessity to harvest or collect large amounts of organisms, as is required for sponges or tunicates. Secondly, it means that a constant supply of material is always available by simply re-growing the cultures as needed.

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— Jeffrey Wright, Ph.D., principal and director of research, MARBIONC

MARBIONC has two valuable and unique collections of photosynthetic and non-photosynthetic organisms representing hundreds of species. Most of these have never been examined for the compounds they make, and many of the bacteria are new species previously unknown and so hold enormous promise as sources of new compounds with important biological activity. Already there has been notable success: cultures of the phytoplankton *Karenia brevis*, produce a new compound named brevenal that may yield a new treatment for cystic fibrosis. The bacterial collection has produced a new anti-TB lead as well as a potential anticancer lead. This is only the start, and other new bioactive compounds are being regularly isolated from the MARBIONC collections. 



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## EARTH AND SEA SOUTHEASTERN NORTH CAROLINA

Terrestrial and marine resources are the basis for the natural product frontier for the 12-county region stretching from Hoke and Scotland east to Robeson, Columbus, New Hanover and Brunswick and north to Sampson and Duplin.

“The Western region is much further along than we are at building a natural products community. In the Southeastern region, we tie in with the Natural Products Center of Innovation initiated in Western North Carolina, in the effort to build a natural products industry across the state,” said Randall Johnson, director of the Southeastern Regional Office of the North Carolina Biotechnology Center. “Here in this region, we’re still building a foundation for biotech and, especially, natural products.”

Muscadine grapes are an emerging bioagricultural opportunity. Muscadines and the wines made from them are known for their high concentrations of Resveratrol, a natural antioxidant in fruits and vegetables. The seeds have the highest concentrations. Duplin Winery in Rose Hill, NC put that fact to work and launched NutraGrape, a daily nutraceutical supplement made from the muscadine grape seed, and The Vine, facial and body moisturizing creams made from grape seed extract.

Biofuels is another developing area where algae can play a key role. Kimberly Jones, a Ph.D. in marine sciences and chemistry instructor at Brunswick Community College, started Alganomics, LLC in Southport, NC a year ago. The focus of the company is to produce biofuels from high density cultures of algae. She’s become the exclusive distributor for AlgaeLink bioreactors in the U.S. and is in the process of setting up her first test project in partnership with the Oak Island wastewater treatment plant. With a 2008 grant from the NC Green Fund, she is progressing toward using the carbon dioxide by-product from an ethanol plant that will be operational in Robeson County as the basis for an algae culturing system.

**For more information, visit**  
**Nutragrape [www.nutragrape.com](http://www.nutragrape.com)**  
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