From Murky Waters Springs Organic Therapies

by Jennifer Tanner

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—Greg Kean


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Chemistry major Brittani McLeod extracts ethanol from a vial in order to send it to the Medical College of Georgia's Cancer Lab for testing. As a method of extracting bryostatin molecules, the ethanol was used to saturate a plant grown through hydrophonics with a solution that included bryostatin-producing bacteria.

It was dark, with below freezing temperatures, at 5:30 a.m. Friday, Jan. 4, when Dr. Thomas Manning, associate professor of chemistry, and two students loaded a van with buckets and rakes for a trip down to the gulf coast of Florida. They weren't making the two-hour drive for sunny skies and sandy beaches; they were headed to mucky waters and thick forest to collect samples of sediment for research on three expensive natural anticancer drugs — bryostatin, ET743 and Taxol.

The three cancer drugs have been harvested from either trees or marine organisms since the late 1960s; but the complicated extraction methods and large quantities of organisms needed to manufacture the drugs have resulted in outrageously high drug prices for consumers. Bryostatin, for example, requires the harvesting of more than 1 ton of a rare marine organism, a species of bryozoan (Bugula neritina), to produce only 1 ounce of the drug. Three full-grown Yew trees are needed to produce 1 gram of Taxol.


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Dr. Thomas Manning collects sediment from the shallow water off Rudloe's dock in Panacea, Fla. in an effort to collect bacteria that may produce the cancer drug bryostatin.

Manning's research to identify less expensive methods of producing these natural therapies began unexpectedly in 2000 during an academic exercise in which students learned to sample sediment for copper and herbicides. In the delta where the Suwannee River hits the Gulf of Mexico, his students found the chemical fingerprint for bryostatin. The surprising find sparked Manning's interest because little research had been done on the drug's origins since its discovery in the 1970s, and scientists had since considered the only source to be the organism, bryozoa.

The professor began groundbreaking research into alternative, less-expensive harvesting methods and initiated a partnership with Jack Rudloe, who was part of the initial bryostatin discovery.

Owner of Gulf Specimen Marine Lab in Panacea, Fla., and collector of marine organisms, Rudloe has proven to be a tremendous asset to Manning and his team of student researchers. Rudloe and his wife, Anne, both marine biologists and dynamic environmental activists, have welcomed Manning's team onto their personal dock, which is one of the few places researchers have found colonies of bryozoa. The veteran scientist has enriched research trips with stories of a friendship with Nobel prize-winning author John Steinbeck, who inspired Rudloe to pursue studies that led to the initial bryostatin discovery.

Manning and his students conducted intense research in specific ecosystems like the one surrounding Rudloe's dock and discovered bacteria, not bryozoa, are responsible for creation of the chemical compound bryostatin. If the drug could be harvested from bacteria — rather than extracting it from a rare organism — then the drug could be produced at a fraction of its current price.

Manning and his team extended their methods of sampling bacteria in sediment where sea squirts live for ET-743 and the ground beneath Yew trees for Taxol. They found all three natural therapies were found in bacteria, not only the organisms or tree bark. Since the discovery, Mannings team has begun collecting sediment from ground beneath the rare Yew trees in Torreya State Park, Fla. in search of Taxol. They have also set up "bacteria farms" along the Gulf Coast to collect new specimens for testing. Placed in specific locations, including Rudloe's dock and a harbor at Alligator Point, Fla., these farms are buckets packed with materials the bacteria find irresistible. In the summer months, bacteria rapidly multiply, giving VSU students plenty of examples to evaluate. When farms are harvested, the material is taken back to the lab for students to examine and manipulate.

Research has shown that this method frequently causes the drug compounds to bind to iron, which Manning believes may actually cause the drug to behave better medically. He is awaiting approval for a patent that will copyright his process for making these FER-MER complexes.

"Our research shows how a simple land-based agricultural approach can be used to produce very expensive or difficult to synthesize molecules," said Greg Kean, a senior chemistry major who has worked extensively with Manning on cancer drug projects.

Manning said he hopes the concept of bacteria farming will lead to the mass production of these drugs. He has contacted the Medical College of Georgia Cancer Research Center for assistance in evaluating the effectiveness of the drug produced at VSU. Thanks to help from VSU alum Warren Fiskus, '96, a post-doctoral fellow at the research center, MCG is testing the drug on cell lines of cancer growth to determine whether the outcome is the same as bryostatin derived from traditional methods. Although the process is extensive and time consuming, Manning recently received word that the first round of testing was effective enough that the laboratory will conduct a second round of tests.

As MCG further evaluates the product, VSU's research team awaits the results of Manning's patent request and continues to make many early morning trips to Panacea, Alligator Point and Torreya State Park for research on these naturally occurring cancer drugs. The young faces of his assistants may change with each semester; but each student experiences hands-on research of a lifetime and in many cases, publishes works about their research to find faster, less expensive production methods that could save millions of dollars.

"The project has produced a number of large scale studies published in international science journals and represents a new, simpler method of making costly pharmaceutical agents," Manning said. "The processes are in optimization stages, but have already served as a springboard for a number of professional careers for VSU students." ■


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A bacteria farm placed in strategic points along the Gulf of Mexico to collect bacteria for research.