



Newsletter

College of Physical and Mathematical Sciences

November 2006

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Y. scientists improve drug synthesis



Morris Robins

Deseret Morning News

October 31, 2006

Lois M. Collins

A team of Brigham Young University researchers has come up with a more efficient way to synthesize the drug cladribine, the treatment of choice for certain "hairy cell" leukemias and a drug that is about to be tested as a possible treatment for multiple sclerosis.

The finding was published this fall in the *Journal of Organic Chemistry*.

It's a process that has a satisfying full-circle quality to it for the professor who led the effort to make the compound more efficiently. Morris J. Robins, the J. Rex Goates Professor of Chemistry at BYU, was the first individual to make the cladribine compound, back in the 1960s when he was a graduate student. But testing at the time by the National Cancer Institute and others "didn't find enough promise," and the compound languished for at least a decade until a doctor at Scripps Institute in San Diego discovered that the drug, used in very small doses, had potent activity against several leukemias and lymphomas, in some cases even prompting remissions. A quarter-century ago, one of Robins' second cousins, a BYU professor named

Roland K. Robins, came up with an improved way to make cladribine.

The new manufacturing process marks a further refinement. Only this time, says Robins, they can make the compound without creating a lot of the extraneous by-product that had to be separated and disposed of as worthless.

Besides treating some cancers, cladribine has been tried in various ways, says Robins — including recently gaining "fast-track" approval by the Food and Drug Administration for Serono to test its new oral cladribine treatment for MS.

"It would be very exciting if they have found ways to treat MS patients, because it's such a debilitating condition," Robins says. MS affects about 2 million people worldwide.

Using the new process developed by Robins and graduate student Minghong Zhong and postdoctoral fellow Ireneusz Nowak, the BYU team has been able to "make the starting material for the cladribine synthesis simply, from readily available materials," Robins says. There are two parts to the molecule, one a heterocyclic base, the other the sugar. To make cladribine, the two have to be coupled together. But if the two parts are not perfectly positioned, useless compounds are also created. And the better the positioning of the two, the more pure the cladribine production, without all that useless excess. BYU researchers can now attach the heterocyclic base to the sugar at least 98 percent in the correct manner, while the attachment of the sugar to the base is perfect. Under the old method BYU had licensed to pharmaceutical companies, 10-15 percent of the positioning was wrong, leading to the need to separate out the cladribine and dispose of everything else that was created.

University of Utah professor of medicinal chemistry and associate dean for research Arthur D. Broom hailed the new process as "a novel, relatively inexpensive and highly specific way" to eliminate production of the by-products, helping keep drug-production costs reasonable.

Thinking Aloud about Statistics

submitted by Kathi Carter

Drs. Shane Reese and Dennis Tolley of the Department of Statistics were participants on the KBYU program "Thinking Aloud" which aired on 26 October, 2006. The program focused on the growing use of data in everyday life. One concerned voiced by the radio host was whether or not individuals could be biased or unfairly influenced by unscrupulous use of data. Both Drs. Reese and Tolley brought forth examples where such has happened, either recently or in the distant past. Neither of the discussants felt that increased regulation or control on printed data would resolve this risk in the future. Rather, the conclusion of the discussants was that there was a responsibility for each individual to become educated in the daily uses of data in order to be an effective citizen of today's society. We are fast approaching the time referred to by H.G. Wells when facility with statistical data is as important to an individual, in order to participate in society, as it is to be literate.

November External Grants Awarded to Faculty

Department	Faculty	Project Title
Physics & Astronomy	Scott Bergeson	Non-equilibrium dynamics of ultracold neutral plasmas
Physics & Astronomy	Scott Bergeson	Research Fellowship from the Alexander von Humboldt Research Foundation
Computer Science	Eric Mercer, Michael Jones, Matt Dwyer	Investigate parallel algorithms for software verification

BYU researchers explore enzyme essential to life



YNews

November 9, 2006

Brigham Young University researchers have developed a better way to study a process essential to the ongoing survival of Earth's plant and animal life.

In the prestigious journal *Proceedings of the National Academy of Sciences*, they report their work on an important enzyme in the bacteria that transform the atmosphere's nitrogen gas into the world's most prolific fertilizer.

"Life depends on this enzyme," said Gerald Watt, the BYU chemistry professor who is actually the second author on the paper, behind one of his then-undergraduate students. "And a vast amount of life on Earth is dependent on the natural process brought about by these bacteria. Our forests, life in the oceans, the mosses on the tundra because nobody fertilizes them, they all eventually get fixed nitrogen from bacterial sources."

Because of the enzyme's importance, it is essential to understand how it works "so it can be safeguarded," said Watt.

In the past, scientists have used synthetic chemicals to study the reactivity of the bacterial enzyme. Watt's team isolated the natural reductant for the enzyme so the enzyme could be examined under more natural conditions.

Their efforts will allow for more accurate and efficient study of the enzyme's role in the creation of "fixed," or

converted, nitrogen, considered the most important nutrient for plant growth because it is involved in almost all biological functions, including photosynthesis.

Douglas Rees, a professor of chemistry at Caltech, says there are still big gaps in scientists' understanding of how the enzyme actually converts nitrogen gas to the "fixed" form of ammonia.

"Gary and his team have made the exciting discovery that the enzyme may be twice as efficient as generally believed in terms of the energy requirement for biological nitrogen fixation," said Rees. "I believe his results represent a major development and provide a great example of how careful experimental work can lead to unexpected findings that challenge the prevailing wisdom in a field."

The BYU research team's findings are available in the online "early edition" of *PNAS* and will shortly appear in its print edition.

The lead author is Thomas Lowery, who is currently finishing a Ph.D. in the Department of Chemistry at Berkeley.

"Thomas is one of our premier students," said Watt, explaining that it is unusual for an undergraduate to be the lead author on a scholarly paper, and even more so to have that paper published in one of the world's top three research journals. "He did excellent work here at BYU and has gone on to do the same at Berkeley."

Lowery says the experience "more than prepared" him to successfully pursue his Ph.D. in Berkeley's chemistry program.

"I can't speak highly enough about my time in Dr. Watt's lab," said Lowery, explaining that there everybody worked together on projects, regardless of station. "As a result, I got to collaborate with other undergraduates, graduate students and Dr. Watt. The experience started my career in science."

Although he found that the work was technically challenging, the time in Watt's lab helped Lowery realize he wanted to conduct research as a profession.

"The great thing was I got to work on a lot of different projects," said Lowery. "BYU does a great job of preparing people for graduate school."

Jared Bunker, also a co-author on the *PNAS* paper, was accepted to UCLA's law school after finishing his work in Watt's lab and earning his bachelor's degree at BYU. The experience working with Watt and Lowery was "a great steppingstone to developing certain skills that have helped me in my professional life."

"Dr. Watt not only had a very big passion for science, but for teaching and sharing that passion," said Bunker, who is now a patent attorney at a law firm in California. "He was a good example of hard work to me. Even though he has done years of research and published many papers, he was always at work early. He not only loved and enjoyed what he was doing, but you could tell he wanted to put in the time required to do a good job."

Other co-authors on the paper are BYU associate professor of chemistry Roger Harrison and graduate students Andrew Nyborg, David Thiriot, Phillip Wilson and Bo Zhang.

Statistics

Submitted by Kathi Carter

On Oct 18, 2006 Prof. C. Shane Reese, Associate Professor in the BYU Department of Statistics, delivered the Keynote Address at the Twelfth Army Conference on Applied Statistics sponsored by the Interface Foundation of North America. The conference was hosted by the National Institute of Statistical Sciences at Research Triangle Park, North Carolina. Prof. Reese's address was entitled "Degrees of Separation: A Case for the Impact of Statistics on Defense." His remarks included a discussion of several of his contributions to weapons system reliability and data combination methods. Congratulations on this distinct honor.

Integration Bee

Twice a year students from BYU and UVSC gather to compete in an Integration Bee. UVSC sponsors the competition in the fall and BYU in the spring.

The UVSC Integration Bee was held on Friday, 3 November. An Integration Bee is similar a Spelling Bee except that students take turns working indefinite, single-variable integrals. In the first round, students went to a whiteboard at the front of the class and were given two minutes to evaluate an integral. If the integral was not evaluated correctly, the next student was given the same integral and an additional minute. If this student was unsuccessful, the next student was given the same integral and 30 seconds to work it. At this point, if the student was not correct, the next student was given two minutes and a new

integral. Students with an incorrect solution were given a strike. Two strikes put them out of the competition.

The Integration Bee ended with a lightning round where the last remaining students went to the board and simultaneously worked the same integral. Any student with an incorrect solution was given a strike. If they are all correct, the last one to finish was given a strike. The winner was the last competitor without two strikes.

The Integration Bee was a great success. There were about 24 competitors (14 from BYU). Mimi's Cafe donated muffins, and the UVSC Math club provided t-shirts to the top 15 finishers and

over \$350 worth of cash prizes.

The top four winners were:

1st Place - Chul-Woo Lee (BYU)

2nd Place - John Shumway (BYU)

3rd Place - Karla Hendricks (BYU)

4th Place - Joseph Adams (BYU)

Important Dates & Events in the College

December 2006

Wednesday, December 6

Physics Colloquium, David Allred
4PM C215 ESC

Thursday, December 7

CS Colloquium, Ricardo Vilalta
11AM 1170 TMCB

Tuesday, December 12

Statistics Seminar, Stephan Sain,
National Center for Atmospheric
Research 3:40PM 1170 TMCB

Wednesday, December 13

Physics Colloquium, Werner Gel-
lermann, Univ. of Utah 4PM C215
ESC

Thursday, December 14

Last Day of Classes

CS Colloquium, Pedro Domingos,
"Unifying Logical and Statistical AI,"
11AM 1170 TMCB

Friday, December 15

Christmas Social 12PM Pendulum
Court

Reading Day

Saturday, December 16-

Thursday, December 21

Final Exams

Monday, December 25

Christmas

Friday, December 29

Grades Submission Deadline

Annual Christmas Social

The Annual College Christmas Social will take place on Friday, December 15 from 11:30-1:30 pm in the ESC Pendulum Court.

Those invited to attend are:

*All full-time personnel "including those on approved leave of absence or disability)

*Approved part-time, non-student personnel (not including on-call or temporary personnel)

*Emeriti and officially retired personnel

Voting Experience Study

Howard B. Christensen, Department of Statistics, is co-PI on three grants totaling \$424,000.00 investigating "Evaluating the Quality of the Voter Experience." These grants come from the National Science Foundation, Carnegie Corporation of New York, and the JEHT (Justice, Equality, Human dignity, and Tolerance) Foundation.

This pilot study in Ohio and Utah in 2006 surveys voters leaving the polling place to measure the quality of their experience. It will systematically assess the conditions of the polling location and match those characteristics with voter attitudes. It also surveys those individuals who work at the polling locations and matches their work to the respondents who voted at that location. This is collaborative research with the BYU Center for the Study of Elections and Democracy.

Distinguished Teaching Award

submitted by David Wright

Professor Kening Lu will be awarded the second annual Distinguished Teaching Award in the Brigham Young University Department of Mathematics on November 30, 2006 at 4:00 p.m. The award will be presented in Room 1170 of the Talmage Math Science/Computer Building. Following the award presentation, Professor Lu will deliver a public lecture on "Dynamical Behavior of Differential Equations." A reception will be hosted in the hallway next to the lecture room at 3:30 p.m.

The Distinguished Teaching Award for the BYU Department of Mathematics was established by a gift from the Kenneth C. Savage Family Foundation as a tribute to the many dedicated teachers in the BYU Department of Mathematics. The stipend for the award is \$1,000. The recipient also receives (for the year) the sculpture *Wildfire* by Helaman Ferguson, a former member of the BYU Department of Mathematics. The sculpture is a solid bronze wild sphere.

Recipients of the award

should be widely recognized as extraordinarily successful in their teaching, have teaching effectiveness that can be documented, have an influence in teaching beyond their own classroom, foster curiosity about mathematics, and generate excitement about mathematics in their students.

Professor Kening Lu is a recognized scholar who has received the BYU Maeser Award for research. He has been a major force in the mathematics department's PhD Program and Professor Lu currently serves as associate chair in charge of graduate studies. He was a cofounder of the Math Circle Program at BYU which provides exciting math to elementary and middle school students. These activities demonstrate dedicated and excellent teaching, but the Mathematics Department Distinguished Teaching Award is given to Professor Lu for his success as an undergraduate teacher. He has the amazing ability to make difficult things understandable to students and shows sincere interest in their learning. When students comment on Dr. Lu's teaching, they use

adjectives like "excellent," "exceptional," "brilliant," "best," and "caring." Students recognize that he is an exemplary teacher:

"Easily teacher of the year, the best instructor I've had in my college career."

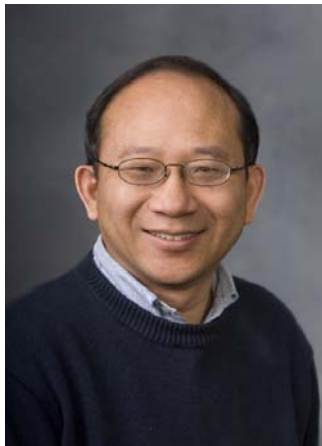
"By far the most organized and brilliant math teacher I've ever had."

"This is the most amazing teacher I have ever had. The course was my favorite."

"I appreciate how much he took interest in me to see that I succeeded. He really helped me when I was having a difficult time. I felt like he really cared."

"Responds well to students – never angry or impatient. I would take any course he teaches."

"Dr. Lu is an amazing calculus teacher. He is fair and wants every student to excel. Because of this, the students do their best."



College Publications

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