Newsletter

College of Physical and Mathematical Sciences

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In this issue:

BYU professors delve into a violin mystery

Owen and Tolley

Tad Hatch
Deseret Morning News
Thursday, November 30, 2006

Antonio Stradivari crafted 1,200 violins before he died in 1737. Today, about 600 of the instruments survive and sell for as much as $5 million.

They are prized for their sound, but for more than 250 years researchers have tried to understand what makes a Stradivarius sound so special. Two Brigham Young University professors provided key clues to a Texas scientist who says he's solved the mystery in an article published Wednesday in the prestigious scholarly journal Nature.

The conclusion? Stradivari and a less-famous contemporary named Guarneri del Gesu boiled the maple in their violins in chemicals, probably to ward off pests. The chemicals added a richness to the sound of the instruments that has not been duplicated.

Texas A&M University biochemist Joseph Nagyvary has spent 30 years trying to prove that chemicals gave the violins their unique sounds, and his research received a big boost when he spoke in Utah a few years ago and met Noel Owen, a BYU professor of chemistry and biochemistry.

Owen told Nagyvary that he had been analyzing wood using an infrared spectrometer for 20 years, since he came to BYU from the University of Wales.

In 2003, two researchers claimed the secret of the Stradivarius was a "Little Ice Age" that gripped Europe from the mid-1400s until the mid-1800s, slowing tree growth and providing unusually dense wood for master violinmakers in 18th century Italy.

Instead, Nagyvary, with the help of Owen and BYU statistician Dennis Tolley, said the new research proves that chemical treatment is the magic ingredient and very well may have been accidental.

Owen analyzed slivers of wood from modern violins and shavings from five antique instruments from the 1700s using an infrared spectrometer in BYU's Ezra Taft Benson Building. Infrared light that bounced through a diamond window onto the samples detected subtle differences between the maple in a Stradivarius and that from other violins made during the same period.

"What we can see is the result of elaborate wood treatment," Nagyvary told Nature. "Woodworm and fungus were significant problems for the craftsmen. They probably boiled the wood in a brine that contained various minerals to exterminate infestations."

The researchers don't know what the chemical recipe was, but it created harder, lighter wood with a smoother sound.

A 1681 Stradivarius and a 1734 Guarneri stole the show at a Utah recital two weeks ago. Deseret Morning News reviewer Edward Reichel wrote that "the Stradivarius had a much richer, mellower and fuller sound than the Guarneri, which sounded somewhat thinner, yet still possessed a fullness that gave it vibrancy."

Owen said statistics professor Tolley's contribution was crucial.

"Articles in Nature are refereed very strenuously," Owen said. "The referees asked us if the differences we saw in the infrared were significant and suggested statistical analysis."

Owen asked Tolley to join the team and provided numerous readings. Tolley's detailed study of those readings showed a significant difference between the woods.

A biomimetics specialist at Bath University in the United Kingdom said the team's work looks sound.

"There is a lot of muck and magic about this type of thing," Julian Vincent told Nature. Better proof would include making violins from the exact wood used by Stradivari, treating one and not the other, and comparing their sounds.

Owen said Nagyvary, who plays the violin, is making violins and using a secret chemical recipe to treat them. His instruments have been praised by professional musicians.

The study caps Owen's career. He retired from BYU in July, though he is still completing research at the university.

"It's a great way to retire from your job," he said. "It's more fun than anything in many ways. I'm amazed at the fuss generated from this little paper."

Some of the fuss, he admits, will come because Nagyvary believes Stradivari and Guarneri stumbled onto their success.

"Nagyvary believes these two masters probably have been given more kudos for this work than maybe they deserve," Owen said. "He thinks the local chemist who gave them the chemicals to protect the wood probably also gave them the means to make the sound so wonderful and then died without knowing what he'd done."

Nagyvary obtained the wood slivers from instruments damaged by fire, flood or other mishaps, Owen said. He is hoping to obtain more samples for tests that would determine the correct chemical agents.

"But in the past," Nagyvary said in a release issued by Texas A&M, "there has been a lack of cooperation from the antique violin business, and that has to be overcome. It may help us to produce violins and other instruments one day that are just as good as the million-dollar Stradivarius. And this research could also tell us ways to better preserve instruments, too."

November External Grants Awarded to Faculty

Department	Faculty	Project Title
Chemistry and Physics & Astronomy	**Paul Farnsworth and Ross Spencer**	Ion Production and Transport in Atmospheric Pressure Ion Source Mass Spectrometers
Chemistry	**Milton Lee**	Chemical and Biological Agent Detector
Chemistry	**Milton Lee**	Portable GC-MS System Development
Chemistry	**Milton Lee**	High Throughput Chemical Analyzer
Chemistry	**Matthew Linford**	Research Collaboration with US Synthetics
Computer Science	**Kent Seamons**	Flexible Access Control Systems for Urban Crisis Response
Physics & Astronomy	**Gus Hart**	Materials World Network

Important Dates & Events in the College

January 2007

Thursday, January 11

CS New Graduate Student Orientation 11 AM 3365 TMCB

Tuesday, January 16

Stats Seminar, "Integrating diverse sources of airshed information" William F. Christensen, 3:40 PM 1170 TMCB

Thursday, January 18

CS Build a career as a Computer Scientist 11 AM 1170 TMCB

Thursday, January 25

Chemistry Seminar, "A Tale of Two Viruses: Infection with HIV and Kaposi's Sarcoma Herpesvirs Via the Same C Type Lectin Receptor" Charles Rinaldo, 4PM W140 BNSN

Friday, January 26

College Annual Awards Banquet, 6:30 PM

Tuesday January 30

Chemistry Seminar, David Nesbitt, 4PM W140 BNSN

Stats Seminar, Gretchen Moisen, 3:40 PM 1170 TMCB

ACM NAMES 41 FELLOWS FOR CONTRIBUTIONS TO COMPUTING AND IT

Winners Represent Leading Industries, Universities, Research Labs

New York, NY, January 8, 2007 -- For his contributions to user interface technology, Dr. Dan R. Olsen, Jr., from Brigham Young University's Computer Science Department, has been recognized, along with 40 other computing scientists and professionals, as an ACM fellow. ACM recognizes a select few of its members each year for their contributions to both the practical and theoretical aspects of computing and information technology. The new ACM Fellows, from some of the world's leading industries, universities, and research labs, made significant advances that are having lasting effects on the lives of citizens throughout the world.

"The breadth and depth of the contributions these computing scientists and professionals have made to our world and the way we live is remarkable," said ACM President Stuart Feldman. "Their work reflects outstanding displays of creativity and commitment to the computing community, which continues to drive innovation in industries and enterprises across the globe. These individuals deserve our acclaim for providing dedicated leadership, solving complex problems, and pursuing productive careers in information technology that have advanced the quality of life for people everywhere."

The technology areas for which these recipients were honored span a wide range of disciplines and applications, including: computational complexity theory; parallel and distributed computation; programming languages; artificial intelligence and cognitive science; information processing and web analysis; resource management of data networks; mechanized theorem proving; numerical algorithms; user interface technology; system software for parallel and distributed computing; database management systems; protocols for packet switched networks; information management and security; and broadening participation in computing.

ACM will formally recognize the new Fellows at its annual Awards Banquet on June 9, in San Diego, CA. Additional information about the ACM 2006 Fellows, the awards event, as well as previous ACM Fellows and award winners is available at www.acm.org/awards <http://www.acm.org/awards>.

Prof's long-ago choice to leave Harvard is a coup for BYU

Linda Fantin
Salt Lake Tribune
Saturday, December 9, 2006

Provo is approximately 2,100 miles from Cambridge, Mass., which doesn't begin to explain the mileage Brigham Young University has gotten out of Daniel Simmons, the scientist BYU lured away from Harvard in 1989.

In Simmons, BYU got a top-notch researcher whose lab work led to the creation of a class of painkillers and gave the LDS Church-owned institution a measure of respectability, especially for a university with no medical school. BYU also nabbed a dedicated director for its Cancer Research Center and a mentor for hundreds of budding doctors and scientists.

The benefits for Simmons are less obvious. In other words, Simmons took a teaching job that actually requires him to teach, and that, say former students, may be his most valuable contribution to BYU - and his biggest reward.

Provo roots: Growing up on the outskirts of Provo, Simmons always was interested in science, the kind of kid who would examine snowflakes under a microscope. At BYU, he earned undergraduate and master's degrees in zoology, then went to the University of Wisconsin for his Ph.D. in oncology.

The Wisconsin work ethic served him well at Harvard, where Simmons earned a post-doctoral fellowship to do cancer research.

From 1986 to 1989, he worked in the lab of Raymond Erikson, one of the country's leading experts on cancer genes. Even then, Simmons had a knack for instruction.

"Dan was first-class, highly collegial. He contributed in a major way to others by offering advice or helping out with his own hands on experiments," Erikson told *The Salt Lake Tribune*. "He was one of the very best post docs I've had in my lab."

While at Harvard, Simmons conducted an extensive analysis of the different messages that are turned on and off in cells as they became malignant, Erikson said. Among the genes that were highly expressed in cancer cells was the COX-2 gene. In 1988, a year before his fellowship ended and while he was still sequencing the genes, Simmons began inquiring about faculty positions around the country.

BYU's Department of Chemistry and Biochemistry had an opening, and Simmons was invited to interview. Simmons, who had family and religious ties to Utah, accepted the offer and prepared to tell his colleagues.

According to the story in *BYU Magazine*, Simmons broke the news during one of the group's twice-a-week "teas," a Harvard tradition since 1953, in which researchers talk shop over Brie and hummus. His announcement was met with "immediate silence," Simmons told the magazine.

"The communal embarrassment of this 'hideous' position was palpable," Simmons said. "They thought I was the most idiotic person there."

Simmons' best friend in the lab offered a reluctant good-for-you - then quickly helped line up a full-time offer at Harvard Medical School. Simmons admitted having second thoughts about his first choice, but for reasons he has kept private, he returned to BYU.

"Not to disparage BYU, but it is unequivocal that, given Dan's talent, he could have landed at a much more visible institution that would have supported his research or at least given him more freedom in doing his research than occurred at BYU," Erikson said. "He could have done much better had he been more patient."

But, as Erikson noted, being patient is tough when you have a family to support, as Simmons did. And living in the Boston area can be a pinch on the pocketbook. So Erikson wished his protege well, and offered a going-away present - the genetic samples from his Harvard research.

"It's always been my practice that people who leave the lab should take with them some project to work on in their own lab," Erikson said. "It's a competitive atmosphere out there, and you can't start from scratch in this day and age."

Heavy load: Once at BYU, Simmons wasted no time. He borrowed Weilin Xie (pronounced Shay), a graduate assistant in another professor's lab, began sequencing a specific gene highly expressed in cancer cells and found it contained an enzyme that causes inflammation. Although other scientists made similar discoveries at the time, the BYU team was the first to publish its findings on the enzyme, dubbed COX-2.

The article was published in the April 1991 issue of *Proceedings of the National Academy of Sciences*, and three months later BYU and Simmons formalized an agreement with Monsanto, the company that would later become Pfizer.

Priority in science is everything. Being second means nothing, Erikson said, noting that BYU didn't give Simmons any easy breaks. Even after it became apparent that the COX-2 story was a big breakthrough, Simmons was still teaching an enormous load for anyone under normal circumstances, Erikson said.

"At a place like Harvard, at many institutions, if something big like that were to happen, some concession would be made to lighten his teaching load," he added.

Brian Ladle, a former BYU student who is about to graduate from Johns Hopkins School of Medicine in Baltimore, has experienced the advantages of working at a larger research school. But as an undergraduate student who benefited from Simmons' willingness to shoulder a full class load, it's hard for him to find fault with the professor's choice.

"At BYU, though funding was limited and my project wasn't as interesting, I had ownership and the focus was on me," Ladle says.

Simmons' teaching may have siphoned time away from research, but it did not stifle his success.

In October 2002, Simmons discovered a third COX enzyme that could unlock the long-baffling mystery of the inner workings of acetaminophen - the drug sold in "aspirin-free" pain relievers such as Tylenol. BYU promptly negotiated a deal with Merck and Co. that will provide the university future royalties in return for licenses on patent-pending biotechnology. Merck also agreed to fund the next 2 1/2 years of Simmons' research.

Motivation: Simmons' interest in pain relief extends beyond the lab; his wife, Trudy, suffers from arthritis and has benefited from using new drugs developed since her husband's findings more than a decade ago.

But it is Simmons' efforts to advance his students' interests that Ladle will remember most. In addition to teaching undergraduate and graduate classes, Simmons started a summer fellowship program at BYU.

"That program kept me in the lab for two summers and not working at a fast-food joint," Ladle says.

Ladle said Simmons is unassuming, and good at explaining basic concepts.

"Some teachers close their eyes and do the same thing again and again, year in and year out. Not Dr. Simmons," says Xie, the graduate student who, after working with Simmons on the COX-2 research, landed a job the San Diego research firm Celgene Corp.

"He's really into it. He feels obligated to do what's best for students."

College Publications

Chemistry

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F. Zhang, G. Jiang, L. Yang, M.V. Lee, R.C. Davis, G. Strossman, M.R. Linford, and M.C. Asplund, "Laser Activation-Modification of Semiconductor Surfaces," *Langmuir,* **22**(26), 10859-10863 (2006).

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Mathematics

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Carlos E. Cadenas, Javier J. Rojas, Vianey Villamizar, "A least squares finite element method with high degree element shape functions for one-dimensional Helmholtz equation," *Mathematics and Computers in Simulation*, Vol. 73, 76-86(2006).

Stephen P. Humphries, "Representations and Rigidity of Aut(F_3)," *International Journal of Algebra and Computation*, Vol. 16, No. 5, 925-929(2006).

Kening Lu, Daoyi Xu, and Zhichun Yang, "Global attraction and stability for Cohen-Grossberg neural networks with delays," *Neural Networks*, Vol. 19, 1538-1549(2006).

Wayne Barrett (Chapter 8 of the book Handbook of Linear Algebra), *Hermitian and Positive Definite Matrices,* 8-1–8-9 (2006).

Physics/Astronomy

M. Transtrum and J. Van Huele, "A perturbative approach to Snyder space with applications," Journal of Physics A, Mathematical and General, 39 14985-14996 (2006).

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