Byu Professor Engaged in Groundbreaking Research

David Dearden thinks about weight and getting in shape more than most physical trainers—for molecules, that is.

As a BYU professor and analytical chemist, Dearden has made significant progress on developing a new scientific technique that has the potential to revolutionize how molecules are identified.

For more than 30 years, Dearden has been working with mass spectrometry—a scientific method to weigh molecules.

“If you can weigh a molecule, you can tell what atoms are in it . . . and how the atoms are connected to each other,” Dearden said. “But mass spectrometry doesn’t usually tell you anything about how the molecules are folded up.”

If a molecule or protein in the body is shaped incorrectly, it can cause severe health issues and even diseases such as Alzheimer’s. If mass spectrometers could be used to determine a molecule’s shape, scientists would be able to better construct correctly formed molecules and understand deformed ones.

The current way to measure a molecule’s shape and fold is called drift ion mobility. While it is an effective method, it requires specialized equipment and dangerously high voltages to work. Dearden’s technique utilizing a mass spectrometer would save money and revolutionize the study of molecular recognition.

“This instrument is really good at measuring mass . . . so if we can add to it this capability of measuring shape as well, then we’ve got an extremely powerful combination,” Dearden said. “We think, in the long run, we’re going to have an extremely powerful new technique.”

Dearden’s article, “Effects of kinetic energy and collision gas on measurement of cross sections by Fourier transform ion cyclotron resonance mass spectrometry” was published in The International Journal of Mass Spectrometry in February 2015.

While Dearden’s technique hasn’t reported identical results to drift ion mobility, it has correctly determined the shape of the molecules. Dearden believes this difference is normal because the experiment’s environment is different from that of drift ion mobility.

“For more than 15 years, we’ve been working on the idea that you ought to be able to make these measurements in an FTICR mass spectrometer,” Dearden said. “About five or so years ago we figured out how to do it. Ever since then we’ve been working on refining the technique and trying to get people to accept it.”

Although his technique is groundbreaking, Dearden has encountered his fair share of skeptics.

“I had a lot of people, including some of the experts in the field of Fourier transform mass spectrometry, say this would never work, but it does work,” Dearden said. “We’re still having challenges. It’s hard to get a new technique like this accepted.”

However, Dearden gladly accepts the questions and criticism.

“Actually, it’s been a really good
Bringing the Past to Life

When it comes to family history and earth history, the two may be more related than we think.

For associate dean Bart Kowallis, the combination of subjects has expanded his understanding of the past — and, for his teaching of family history, and his excellent service as an instructor, he has been awarded the Religious Education Transfer Professor Award by BYU this year.

The Religious Education Transfer Professor Award honors one faculty member outside the College of Religious Education who teaches religion classes.

In teaching two different subjects, Kowallis has found some similarities. “In geology, we look at rocks and interpret what happened in the past,” Kowallis said. “With family history, we look at clues from documents and try to understand what happened in the past. They both deal with old, dead things. That makes both of them quite similar.”

“Teaching family history . . . it’s really not much different than [teaching] geology,” Kowallis said. “In both subjects, we’re like detectives trying to find clues, interpret those clues, and understand what happened without actually having been there.”

With both geology and family history, Kowallis encourages his students to personally interact with the subject at hand. Whether it is geology students going on field trips up Rock Canyon, or genealogy students digging into their own family history, they can have a hands-on experience with history.

“I enjoy the great students we have here at BYU,” Kowallis said. “They’re bright, good, and want to learn. That’s the thing I enjoy most — the interaction with them.”

Kowallis strives to get to know his students on a personal basis. He conducts discussion-based classes. “One of the most effective things is getting to know every student’s name and something about them,” Kowallis said. “That connects you more directly with the student and makes them more interested in what you’re talking about.”

During his career, Kowallis has taught a wide variety of geology classes and has worked with a number of undergraduate and graduate students on research projects. His research in mineralogy and petrology has focused mostly on rocks in Mexico and Utah. Kowallis and his students have presented the results of this research at various conferences across the United States and around the world. In the process, he has met many interesting people.

Although he has mostly taught geology and physical science throughout his 34 years at BYU, winning various awards during that time, Kowallis has also enjoyed teaching family history. “I enjoy the fact that [students] are getting to know and connect with their family and their ancestors,” Kowallis said.

By Camilla Stimpson

Groundbreaking Research

thing. It’s the way science is supposed to work,” Dearden said. “I love it when they come after us that way because it makes us do the science better.”

Dearden looks forward to publishing more articles on his research and presenting it to his academic peers. “A lot of research that most people do, and that I do, is [about] incremental changes, but this is radically different,” Dearden said.

By Tanner Call
lot of really bright people on campus and a lot of really great ideas coming to the Technology Transfer Office."

Graves expressed his gratitude to the college, the Technology Transfer Office, and especially to the graduate and undergraduate students who work with him on this research. "I’m very grateful for the students who have really made this happen," Graves said. "The idea may have started with me, but they really made it happen."

As students work with Graves, they do far more than just help with his research. They also gain valuable knowledge in chemistry and biochemistry, and they learn how research takes place in real life. It may even seem surprising to hear that much of their learning comes from making errors.

"These are hands-on, practical, real-life questions," Graves said. "It’s not a laboratory procedure that’s been done a hundred times. This is all brand new and we make a lot of mistakes."

As strange as it may sound, mistakes are not a sign of failure, but a sign of potential progress. "It’s very valuable for them to see their mistakes," Graves said. "It gives them a much better sense of what real-life work and real-life research are all about. . . . [It] equips them with certain tools that they can use hereafter."

During his 17 years at BYU, Graves has seen many of his students accomplish goals and do great things in their careers. "It’s always very gratifying to see somebody who became a committed learner . . . interested in asking questions about the world," Graves said.
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