Brigham Young University ranks number one in the nation in the production of high school physics teachers. According to data collected by the Task Force on Teacher Education in Physics (T-TEP), the BYU Department of Physics and Astronomy graduated 14 physics teachers last year, more than any other department in the United States.

The Task Force, a special initiative of the Physics Teacher Education Coalition, documents the preparation of physics teachers and makes recommendations for how individual colleges can improve their physics teacher education programs.

T-TEP noted several outstanding features of BYU’s program that make it exemplary, including the department’s large enrollment with multiple opportunities to enter the teaching track, close mentoring of teacher candidates by experts, and a tenure-track faculty position for heading physics teacher education.

Probablility of Success Goes Up with Mentor

What are the odds of an undergraduate student being able to write a research paper in statistics that involves computational and mathematical analysis?

Much higher when guided by a mentor.

Two years ago, statistics student Sarah Wilde teamed up with Dr. Scott Grimshaw through IMPACT (http://goo.gl/iw9Bs), a program that trains undergraduates in selected topics from upper-level courses in statistics, computer science, and math.

Dr. Grimshaw’s work in those three areas made him the perfect mentor for Wilde.

“I work on research problems where statisticians have computational problems that would be interesting to computer scientists and vice versa,” said statistics professor Dr. Scott Grimshaw.

Dr. Grimshaw’s and Wilde’s efforts resulted in a recently published peer-reviewed paper that demonstrates a reasonably simple method to approximate a family of estimators, even for data that has outliers.

“I could tell that [Dr. Grimshaw] knew what he wanted me to do with the project,” Wilde said. “But he helped guide me to get there on my own.”

Dr. Grimshaw’s mentoring helped Wilde gain skills important for her job as a website analyst for Overstock.com.

“For my interviews for different positions I’ve held, they’ve asked me a lot about . . . my research,” Wilde said. “Some of the research process—the things I’ve learned while doing the project—I have actually used, because I work in a statistical job right now.”

Dr. Grimshaw remarked that the research process, especially for an undergraduate, is often not easy to navigate. The research paper itself took almost a year to complete.

“Wilde is very smart, highly motivated, a good writer, very patient,” Dr. Grimshaw said. “A lot of times with research, you go down dead ends, and she went down more than her fair share...
Genetic Cause for Migraines Found

As a teenage student athlete, Emily Bates hated never knowing when the next migraine would strike, disrupting her schoolwork, practices and competitions.

Now it’s payback time.

The BYU chemistry professor published research ago in Science Translational Medicine that identifies mutations in a gene that makes people more susceptible to migraine headaches. The study is the first demonstration of a genetic cause for the common migraine and is an important step in the search for a cure.

“I had migraines really frequently and severely,” Bates said. “I would lose my vision, vomit uncontrollably—it would wipe out an entire day. I decided then as a high school student that I was going to work on migraines, that I was going to figure them out and help find a cure.”

Her last migraine happened the day before a marathon she planned to run in October 2003. Though her migraines eventually stopped, she didn’t.

After earning a PhD in genetics from Harvard, Bates did post-doctoral research with a team of geneticists at UC San Francisco’s medical school. This gene-hunting party worked with two families that appeared to have a dominantly inherited form of the affliction.

The researchers zeroed in on genetic mutations these families had in common mutations that affect production of a protein known as casein kinase delta.

To test whether this was a cause or a coincidence, Bates designed an experiment to determine whether the same genetic trait led to migraine symptoms in mice.

“All sensations become amplified with migraines, including touch, heat, sound and light,” said Bates, who continued work on the project when she took a position at BYU in 2009.

The researchers observed this heightened sensitivity in the migraine mice in very subtle ways—from the warmth of a tiny light and the pressure of a single hair-like filament.

“It’s a molecular clue,” Bates said. “Now we can try to figure out what this specific protein affects in the body and how that is involved with migraines.”

Nearly 12 percent of Americans experience at least one migraine each year. Women are three times more likely to suffer from migraines.

Thankfully, a teenage girl decided to use her brain to fight the headaches.

“There haven’t been a lot of people working on migraine research, mostly because it’s so complex and unpredictable,” Bates said. “This represents a lot of work to find and see the differences.”

K.C. Brennan of the University of Utah and Robert Shapiro of the University of Vermont authored the study with Bates.

Adderall Use as College Study Aid ‘Trending’ on East Coast

A growing number of college students are using the ADHD medication Adderall to give them an academic edge, and they’re tweeting about it.

Thanks to Twitter, tracking roughly when and where Adderall use happens is now possible. So a group of BYU health science and computer science researchers did just that.

Their six-month study, appearing in the current issue of the Journal of Medical Internet Research, produced two major revelations about Adderall:

It is mentioned most heavily among students in the northeast and south regions of the U.S.

Tweets about Adderall peak sharply during final exam periods. “Adderall is the most commonly abused prescription stimulant among college students,” said lead researcher Carl Hanson, a professor of health science at BYU. “Our concern is that the more it becomes a social norm in online conversation, the higher risk there is of more people abusing it.”

For the study, researchers monitored all public-facing Twitter mentions of “Adderall” between November 2011 and May 2012, but removed tweets from users whose screen-names indicated they were promoting Adderall.

The results showed 213,633 tweets from 132,099 unique users mentioned the drug during the study, with an average of 930 per day. Though the analysis didn’t sort out “legal” vs. “illegal,” use, Adderall tweets spiked sharply during traditional finals periods, with peaks on Dec. 13 (2,813) and April 30 (2,207).

Researchers also found that Adderall tweets peaked during the middle of the week and declined by the weekend. Both findings are consistent with previous research that shows college students who abuse ADHD stimulants do so primarily during times of academic stress.

by Joe Hadfield
Physics Teaching continued from page 1

Professor Duane Merrell is the person behind BYU’s great success in physics teacher education in recent years. According to Merrell, the reason behind the considerable shortage of qualified physics teachers is lack of exposure.

“No one has learned how fun it is to teach physics! People think it is hard,” he said.

Merrell identified BYU’s unique culture, as well as the large size of BYU’s physics department, as a major source of the physics program’s success.

“Students around here like to teach,” he explained. “I think the culture of our community says teaching is a good profession.”

BYU is one of the few universities nationwide that trains physics teachers through the physics department rather than through the school of education.

“We teach our own physics teachers, but we have a very good partnership with the McKay School of Education,” Merrell said. “They help us with getting teaching licenses and placing student teachers. We do the rest of the work in preparing them to be physics teachers right here in the college.”

The need for more physics teachers is evident. According to the Coalition’s web page, two-thirds of new physics teachers do not hold a degree in physics and more than 90 percent of middle school science students are taught by teachers who majored in a different subject or who lack certification in physical science.

To improve national preparation of physics teachers, Merrell explained that students need someone to guide them through the process of becoming a teacher—someone to show them how easy it is for a physical science student to transition to teaching.

“I am absolutely willing to be the champion for any student that walks through this door to figure out a way that they can do this,” Merrell said. “They don’t leave here discouraged.”

Adderall continued from page 2

“It’s not like they’re using it as a party drug on the weekend,” Hanson said. “This data suggests that they’re using it as a study aid. Many of the tweets even made a study reference.”

The rate of Adderall tweets was highest among college and university clusters in the northeast and south regions of the United States. Researchers surmise that the high activity in those areas could be connected to the fraternity/sorority system, which has deep roots in the northeast. Vermont had the highest per capita Adderall tweet rate, followed by Massachusetts and Alabama, while Southeast Texas had the lowest, followed by Central Illinois and Northern California.

The Northern Utah college cluster was one of the lowest Adderall-tweeting areas, as were a number of western areas such as Phoenix, Los Angeles and Reno.

The Twitter analysis also revealed that 9 percent of Adderall tweets mentioned another substance, with the most common two being alcohol (4.8 percent) and stimulants like coffee or Red Bull (4.7 percent). Other substances included cocaine, marijuana, methamphetamines and depressants such as Xanax.

“Tweets hinting at co-ingestion are particularly troubling because morbidity and mortality risk increases when substances are combined,” said study co-author Michael Barnes.

Researchers hope the study renews interest in promoting the safe and legal use of Adderall and other substances on college campuses. Additionally, authors hope to spark more promotion of student well-being and study habits to better manage the academic demands and pressures of college.

BYU computer science professor Christophe Giraud-Carrier and PhD candidate Scott Burton, along with health science professors Josh West and Michael Barnes, were co-authors on the study.

by Todd Hollingshead
of dead ends. So at times we had to say, ‘OK. That approach isn’t going to work. How about this one?’”

The opportunity to write a research paper as an undergraduate may sound like an outlier, but in reality, the College of Physical and Mathematical Sciences has over 250 undergraduate students who have either presented at a professional conference or co-authored a research paper.

by Curtis Penfold

College Publications

Chemistry


Statistics


