November | 2014

FACULTY newsletter

CPMS Physical and Mathematical Sciences

Cancer Research Center Renamed

Above: In The Simmons Center for Cancer Research, a student researches possible causes and treatments for cancer.

The College of Physical and Mathematical Sciences and the College of Life Sciences recently announced the renaming of the BYU Cancer Research Center to "The Simmons Center for Cancer Research." This name change comes as Dr. Daniel L. Simmons steps down as director of the center after seventeen years of service.

Simmons earned bachelor's and master's degrees from BYU in 1978 and 1980, respectively. He received his PhD from the University of Wisconsin–Madison in 1986. Following his doctoral work, Simmons worked as a postdoctoral fellow at Harvard University until 1989, following which Simmons joined the BYU Department of Chemistry and Biochemistry as a professor. He became the director of the Cancer Research Center in 1997. He is the discoverer of the COX-2 enzyme, which led to the development of several prescription painkillers, the first being Celebrex, which is often used to treat arthritis pain.

Replacing Simmons as director is Merrill J. Christensen of the Department of Nutrition, Dietetics, and Food Science, who previously served as associate director, a position Steven L. Castle of the Department of Chemistry and Biochemistry will now fill.

"I hope to see the current programs expand and grow under the inspired new leadership," Simmons said. "I think we've only just begun to scratch the surface of what BYU can contribute to this important field."

In 1971, President Harold B. Lee made a prophetic statement at the inauguration of BYU President Dallin H. Oaks that would later serve as a guide for the establishment of the Cancer Research Center.

"We would hope that you would give to students of this institution the vision of possibility that the Eyring Science Center (where the Department of Chemistry and Biochemistry was then housed) could make a significant contribution to the discovery of a cure for cancer—that treacherous disease which took the life of the great scholar, Dr. Carl Eyring, after whom that building was named," President Lee said.

The BYU Cancer Research Center was established in 1977 as a joint venture between the Department of Biology, the Department of Agriculture, and the Department of Chemistry and Biochemistry. Dr. Roland K. Robins, a prominent medicinal chemist and cancer researcher, served as the first director.

The center is committed to giving students the opportunity to become directly involved in cancer research and the search for a cure. In 1997, Simmons initiated the Cancer Research Center's fellowship program, which has since provided more than 200 undergraduate and graduate students with funding for cancer research.

Currently, the center is composed of distinguished professors and researchers from chemistry and biochemistry, chemical engineering, integrative biology, nutrition, health sciences, microbiology and molecular biology, dietetics and food science, statistics, and physiology and developmental biology. Students have the opportunity to study under these professors as they research possible causes and treatments for cancer.

"The [Simmons Center for Cancer Research] will continue to be a 'student-centric' organization," Christensen said. "As money is made available, we would hope to be able to give support to capable and deserving students year-round to do projects directly related to some aspect of cancer causation, epidemiology, prevention, diagnosis, or treatment."

Christensen received a BS in nutritional science with a minor in chemistry from BYU and a PhD in nutritional biochemistry and metabolism from the

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CPMS Associate Dean Honored with Outstanding Alumnus Award

Above: Associate Dean Dr. Tomas Sederberg, Department of Computer Science

Dr. Thomas Sederberg, associate dean of the College of Physical and Mathematical Sciences, was honored with a 2014 Outstanding Mechanical Engineer alumnus award at Purdue University on November 7. This award recognizes Purdue alumni who have demonstrated excellence in their professions related to mechanical engineering and who have "shown outstanding character and leadership and have accomplished great things," according to the website.

Sederberg received his PhD in mechanical engineering from Purdue University in 1983. Following his doctoral work, he returned to BYU, where he received his bachelor's and master's degrees, to join the Department of Civil and Environmental Engineering.

"I loved my experience as a student at BYU and I loved the faculty," he said. "There is something special about BYU and I wanted to be a part of that."

After spending thirteen years as a civil engineering professor, Sederberg realized that his research interests were more related to computer science and mathematics than civil engineering. "I asked the computer science department chair if it would be possible for me to become an adjunct member of the department so I could advise computer science students . . . and he came back and asked if I would be interested in becoming a full-time computer science professor," Sederberg said. "It was a very fortuitous opportunity for me."

Since 1996, Sederberg has been a professor in the Department of Computer Science where he researches computer graphics and computer-aided geometric design. In 2003 Sederberg invented a technology called T-splines that made the design of irregular free-form shapes easier and more mathematically sound. In 2004, he co-founded with his son a company called T-Splines, Inc. to commercialize his technology. The company was acquired by Autodesk, the world's largest CAD company, and T-Splines is now widely used in Autodesk software.

Sederberg became the associate dean of the College of Physical and Mathematical Sciences in 2005. He is the recipient of many awards, including the Steven V. White University Professorship, the Karl G. Maeser Distinguished Faculty Lecturer award, the Computer Graphics Achievement Award, and the Pierre Bezier Prize.

Reflecting upon his most recent award from Purdue University, Sederberg is grateful for the strong education in research he received while pursuing his doctorate at Purdue.

"One of the most important lessons I learned was how to be an independent researcher and how to identify important problems," he said. "I had a lot of freedom as student to find and pursue my own research interests, and, having successfully gone through the experience, I came away with a deep self-confidence."

By Meg Monk

Frozen Co-Director Encourages BYU Animators to Provide Hope

Above: Co-director of Frozen Chris Buck addressing BYU animation students.

BYU animation students learned firsthand from the director of the highest grossing animated movie of all time in a lecture on campus.

Chris Buck, the co-director of *Frozen* who also worked on Disney's *Tarzan*, *Pocahontas* and *The Little Mermaid* and co-directed Sony's *Surf's Up*, provided in-depth detail about the making of *Frozen*. He also spoke about the importance of inspiring others and providing hope to those who need it.

"Animated movies," Buck said, "as much fun as we all have making them, and they are for the most part fun, there is still depth to the best ones that people relate to and a depth that can help people and give them hope."

The message aligned directly with the emphasis that the BYU Center for Animation puts on creating good, clean, positive content. That emphasis has been well documented as animation students win national awards for their work year after year. The animation program's unique culture was also featured in an in-depth piece from the New York Times last year.

Buck closed by talking about the future that lies ahead for BYU animation students.

"I'm handing the torch over to you guys," Buck said. "You guys are going to be doing it. Don't take that responsibility lightly because what you do is very important. And especially families – especially young kids – watch these movies, as you know, as you all did, we all did, over and over and over and over and over, until you can memorize the whole movie. But whatever message you're putting in there really sinks in, and hopefully it will always be a good message."

By BYU News

Philosophical Questions in the Math Department

Above: Dr. Pace Nielsen, Department of Mathematics.

To be or not to be a math major or minor? That is the question for many BYU students.

On October 16, the Department of Mathematics tried to answer that question by hosting an information session to introduce students to the math major and minor. Department chair Robin Roundy gave a brief introduction to the mathematics program and told students about opportunities available to math graduates.

"The variety of things you can do with mathematics is huge," he said, "and many of them are extremely exciting. . . . If you become a math major, you will be joining an elite group."

Several professors in the mathematics department then presented information and their own experiences with math. Dr. Pace Nielsen shared his experience working with students in math research and described his enthusiasm for this research, even when some problems seem to be unsolvable.

"That's the cool thing about math," Nielsen said. "You ask these really easy questions, and their answers are hard. It's hard work. You work at it, and you work at it, and sometimes you solve it and sometimes you don't. That's just the joy of mathematics. You enjoy the beauty of it all."

After Nielsen praised the beauty of math research, Dr. Tyler Jarvis described the beauty of career options for math graduates and illustrated the course map for math majors. Jarvis said that a math degree offers opportunities to work in industries across the board, and that mathematics majors fit several different job descriptions.

"[A job posting] doesn't necessarily say 'mathematician,' but they still want a mathematician," he said.

He said that math graduates have been hired by Google, Amazon.com, Target, Adobe, Pixar, and the National Security Administration, among others.

To help prepare students for careers in these industries, the mathematics department introduced the Applied and Computational Mathematics Emphasis (ACME). This emphasis is a relatively new program for math majors that specifically prepares students to work in industries by teaching them important theory relating to data computation.

Getting into industries often requires that students find and participate in internships. The department internship coordinator Lisa Winegar told students about the basics of getting an internship and the benefits of working in one.

"Junior year, [an internship] should be heavy on your mind," she said. "Right when the fall semester starts, you're there. . . . You need to find a way to differentiate yourself, and an internship is a solid way to do that."

To round out the session, student Abby Boekweg shared information about the math student activities council and the Women in Math Club. She told students that the department welcomes suggestions and comments.

Finally, Roundy closed the meeting by encouraging students to move forward and research the majors that interest them.

"If you're not sure what you're going to major in, pick one and start taking classes," he said. "Start talking to people who are in that major and ask them what they're doing. Ask them to tell you about it. Go talk to a professional and have them tell you about what they're doing. See if you like it."

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Massachusetts Institute of Technology. He joined the Department of Nutrition, Dietetics, and Food Science at BYU in 1982. To further his training in cancer research, Christensen took leave to work in oncology and molecular biology at the McArdle Laboratory for Cancer Research at the University of Wisconsin-Madison. He then returned to BYU.

From 2005 to 2010 Christensen served as a member of the Chemo/Dietary Prevention of Cancer Study Section of the National Cancer Institute. He has been awarded the College Creative Achievement Award, a College Professorship, the John A. Widtsoe Fellowship, and, in August 2014, the Abraham O. Smoot Citizenship Award. Christensen's current research focuses on the essential trace element selenium, on compounds found in soy, and on the molecular mechanisms for their protective effects, individually and in combination, against prostate cancer.

"I am very grateful to be working with such capable and conscientious people," he said. "I am sobered by the responsibility . . . but also excited and motivated by the challenge and possibilities."

Steven L. Castle, who will serve as associate director, has been a member of the Cancer Research Center since 2004. His current research is in the synthesis of natural products and related structural analogues that possess anticancer activity or other medicinal properties.

"I am honored and excited to receive this opportunity to help lead the [Simmons Center for Cancer Research]," Castle said. "I will work to ensure that the center continues to fulfill its mission of providing opportunities for undergraduate and graduate students to participate in high-quality basic research related to cancer."

Castle earned a BS with honors in chemistry from BYU and a PhD in chemistry from The Scripps Research Institute in La Jolla, California. Following graduation, he worked as a National Institutes of Health Postdoctoral Fellow at the University of California, Irvine. Castle joined the BYU Department of Chemistry and Biochemistry in 2002.

"By training the next generation of cancer researchers and enabling fundamental discoveries that help us understand and treat this terrible disease, the center plays a critical role in the BYU community," Castle said.

By Meg Monk

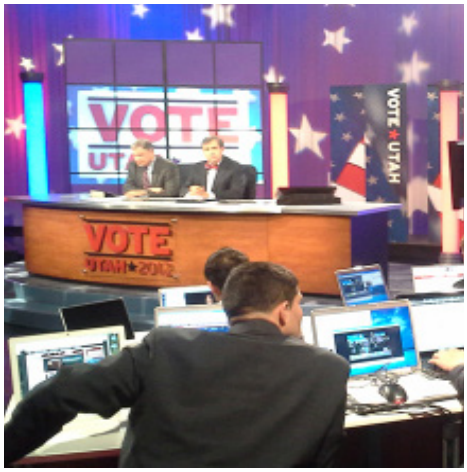
Faculty Funding and Publications Goals

Teaching Moment

Dr. Duane Merrell's teaching tip is to engage the students in what they are learning and enable them to become active in the learning process. "As a teacher, you are to engage, enthuse, enlighten, and energize your classroom so the student will engage in concepts and ideas you are guiding them to explore."

Dr. Merrell gets to know his students by name, and he watches out for them. He has found that professors are most effective when they enable the students to learn from each other and guide one another to new ideas.

Calculating the Statistics of Success



Above: BYU statistics students work with volunteers across the state to predict the exit polls.

What's the probability that a few collegiate departments around the state could get together and predict the winners of the mid-term election?

Not too likely in many states, but it happens on a regular basis in Utah.

BYU's Department of Statistics and Department of Political Science, in conjunction with political science departments in five other colleges and universities in Utah, predicted that Mia Love would win the contested seat in congress by a margin of 50.6 (Love) to 47.0 (Owens). The actual percentage ended up being 50.04 to 46.75.

Every two years, students all over Utah participate in the exit poll project. Statistics and political science student volunteers take voter surveys at the polls, and then statistics students analyze the data and project the winners in the elections. Students selected from the BYU statistics and political science classes then appear on KBYU to discuss the exit poll and other political topics, and announce their results once the polls close. In all of their years running the exit poll program, they are nearly always correct in their predictions.

Dan Williams, the adjunct faculty member who guides the statistics students through the exit poll project, said that though accurate results are always good to see, the process itself is the truly valuable part for the students.

"The process we are participating in is real," Williams said. "It was the exit poll that got me the experience to help me excel at my first job. It was the experience received here [at BYU] that allowed me that extra leg up on the competition. Doing this work, for the students, helps solidify years of study."

His team of ten statistics students started preparing for Election Day in May. The students were split into groups that determined how the sample of voters was to be selected, created computer programs to pull the data together, analyzed the data the day of the election, and manned crisis teams to handle any unforeseen circumstances, among many other tasks.

"I looked at the historical data [from past exit polls] to predict the turnout of voters in polling locations," Maddison Phan, a senior studying statistical science, said. "We used that data to sample and properly weight the surveys we received from the different locations."

Dr. Howard Christensen, an emeritus statistical science faculty member, and Dr. David Magleby, a faculty member in the political science department, have been part of the exit poll program since its beginning in 1982 Christensen is pleased with the growth and accomplishments of the program. The statistical component of the operation started with about five statistical science students and a sample size of approximately 1,100 voters. Now it has grown to 1,200 students across the state and a sample size of about 13,000 voters this year.

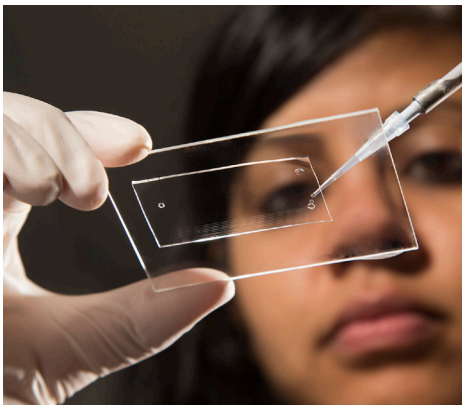
"I was involved on Tuesday (November 4), and I saw the various things going on in the crisis center," Christensen said. "I saw such a core of very capable students. They were handling the problems and occasionally they would come and ask for guidance or ask for ideas, but most of the time, they had solutions all ready to go. We were seeing really capable students doing a really great job."

This experience shows the students what they are capable of, and that valuable insight is the real purpose behind the project, Christensen continued.

"The important thing [in the exit polls project] is the large number of students who gain an invaluable, real-world experience that often becomes a highlight of their college and university education," Christensen said.

By Mackenzie Brown

How Far Urine Flows in a Tiny Tube Says a lot About Your Health



Above: Dr. Adam Woolley and his team have discovered a new way to find cancer. Photo courtesy of Mark A. Philbrick

When you flush the toilet, you may be discarding microscopic warning signs about your health.

But a cunningly simple new device can stop that vital information from "going to waste."

Brigham Young University chemist Adam Woolley and his students made a device that can detect markers of kidney disease and prostate cancer in a few minutes. All you have to do is drop a sample into a tiny tube and see how far it goes.

That's because the tube is lined with DNA sequences that will latch onto disease markers and nothing else. Urine from someone with a clean bill of health would flow freely through the tube (the farther, the better). But even at ultra-low concentrations, the DNA grabs enough markers to slow the flow and signal the presence of disease.

"In a disease state, this particular marker is equal to about one billionth of a percent of the content of urine." Woolley said. "We can detect close to those levels. If we can get below that, it would give us better sensitivity for somebody at an early stage of the disease."

Grad students Debolina Chatterjee and Danielle Mansfield co-authored the study for the journal Analytical Methods using synthetic urine samples. The next step is to do human trials with this "lab on a chip."

The method holds several advantages over current tests for prostate cancer: No blood draws, instant results and potentially higher accuracy.

Men who get their blood screened for a prostate specific antigen are really only learning whether their prostate is enlarged, and sometimes cancer is the cause.

But the BYU device works only when there is an exact match to a disease marker that is 22 RNA bases long. Harmless material that closely resembles the disease marker doesn't sound a false alarm.

"The flow distance is about 20 to 40 millimeters longer if just one of those 22 letters is wrong," Woolley said.

Although the new study specifically looked at prostate cancer and kidney disease, this same method could be used to make a diagnostic tool for other diseases.

"In a urine sample there can be millions of different sequences of micro-RNA and what we need to do is find the ones related to a disease," Woolley said.

by BYU News

The Bandwagon is Your Second-Favorite Team

Above: Former BYU star Ziggy Ansah now plays in the NFL for the Detroit Lions, who lead the NFC Northern Division with a 6-2 record.

When it comes to watching NFL games in Utah on television, the most popular teams are the Broncos, Cowboys or 49ers.

But a new study by Brigham Young University and the Fox affiliate in Salt Lake City shows that choosing to broadcast a local favorite isn't always the smartest ratings decision.

"When you look at the difference between the average team effect, like say the Miami Dolphins, and the next top tier after the Denver Broncos, the results are small, practically insignificant," said BYU statistics professor Scott Grimshaw. "We went in thinking that we would find the next big team, but really we found no difference."

Grimshaw teamed up with Scott J. Burwell of Fox 13 in Salt Lake City on a report that appears in the Journal of Quantitative Analysis in Sports. Their model predicts within a local market which matchups would generate the largest TV audience.

Based on actual ratings data, the analysis shows that fans don't just watch their favorite team - they also hop on the bandwagon of whoever is winning and lighting up the scoreboard. And when two high-scoring, winning teams play, it's ratings gold.

Looking ahead to the Week 14 games in December, the statistical model Grimshaw built does not favor Fox 13 broadcasting the 49ers game despite their relative popularity in Utah. That's because the Seahawks, last year's Super Bowl champions, face Chip Kelly's fast-paced Eagle's offense during the same time slot. That matchup will draw higher ratings in Utah than the 49ers contest against the winless Raiders.

"One of the intriguing conclusions is that these are a ranking of teams against hypothetical situations," Grimshaw said. "NFL games are the premier local TV program and the station can profit from choosing the right game."

Although he found NFL teams have similar popularity, Grimshaw knows that every sport and league is different. Take college basketball's March Madness, for instance. Grimshaw previously did a study showing that little-known Cinderella teams draw 35% higher ratings than powerhouse schools with national name recognition.

"The Cinderella teams, with all the national media attention they get, become a national star," Grimshaw said. "It's not that these schools have an established national fan base, it's that the NCAA tournament celebrates the Cinderella more so than other sports."

By BYU News

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Derek Ostrom, a junior majoring in physics, said that he attended the event primarily to learn more about the ACME major.

"I've been thinking a lot about the ACME major," he said. "What I do right now is computational research in the physics program, so I like the computational approach [of ACME]. I've been thinking about it, and I just wanted to learn a little bit more."

Similarly, computer engineering student Hailey Bishoff said that she too has been considering a math major.

"I have a declared major of computer engineering, but calculus has always interested me," she said. "I just thought I'd come and check it out. . . . I might change my major or maybe I'll just get a math minor with computer engineering, because that would probably be helpful. I'm definitely going to look into a math major more."

To be or not to be? That is still the question, but students who attended the event have a little more information to use in their decision-making.

By Jennifer Johnson

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