Newsletter

College of Physical and Mathematical Sciences

Summer 2005

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Star-tip enterprise

BYU facility boldly goes where no planetarium has gone before

By Doug Fox

Sunday, May 15, 2005

When it comes to university planetariums, one might say Brigham Young University's recently revamped facility is like a star among nebulas.

BYU's new planetarium not only boasts a state-of-the-art 3-D projector so precise that it is capable of re-creating the night sky at any time in history, but it also features a one-of-a-kind acoustics treatment designed specifically for domed structures that makes it a truly unique facility.

The combination of the two provides the perfect environment for studying the universe—an exciting prospect both for students in BYU's astronomy program and members of the public attending various shows at the planetarium, where one can not only learn about the stars, but also the gaseous nebulas from which they were created.

"Astronomy is one of the sciences that people can be very passionate about," said Jeannette Lawler, a member of BYU's Physics and Astronomy Department who serves as the director of the planetarium, which is located on the fourth floor of the Eyring Science Center. "It's fun. It's exciting. You're discovering new things. There's a whole explorer mentality about it, and having a planetarium makes it much more convenient to excite people about astronomy."

BYU's previous planetarium had become outdated, said J. Ward Moody, a physics and astronomy professor instrumental in pushing plans for the new facility forward. The old planetarium had been built in the late 1950s.

"Since that time, the student body had grown so much and the planetarium had aged to where the equipment was not adequate and the size wasn't adequate," he said.

Moody said the project, funded entirely through private donations, took about four years to complete. The new facility, which debuted in March, has increased educational opportunities for students, who now are not only able to study the heavens in a modern structure, but also will have occasion to teach visiting groups as well.

"The kind of learning opportunities they have now are those consistent with the goal of giving our students as many hands-on experiences as possible," Moody said, "Those who are our majors will learn how to use a first-rate facility to teach.

"And more importantly, the students being taught will get to learn about the sky with a very true representation of it right there in their classroom. We should be able to teach them all aspects of the night-time sky without having to come back at night, and without having to suffer through the weather and things like that that really limit us, and in the past have restricted us to maybe one experience like that a semester."

Indeed, It's (sic) difficult to study something you can't see, and Mother Nature often interferes with the clarity of the night sky. Poor weather, or something as simple as cloudy skies, often limited effective learning opportunities.

Tabitha Bush, a 25-year-old senior set to graduate in August with a major in physics and an emphasis in astronomy, has studied the skies from both sides now during her tenure at BYU—having passed through part of the program while the planetarium was out of commission yet being around for the new facility's opening.

There's no comparison between the two, she said.

"When it was cloudy we would use a program called 'Starry Night' and it would bring up stars and then we would just have to project it onto a flattened wall," she said of astronomy classes where she served as a teacher's assistant before the new planetarium opened. "We would go through and teach them the constellations in little sections, but I think it was harder for them to piece together in the real sky because you were just looking up at one flat square of sky and another flat square of sky. You can't see the curvature or even how they relate to each other whereas in the planetarium they're all connected."

Now Bush, who is president of the BYU Astronomical Society, finds herself creating her own presentations and conducting them for public groups under the stars of the new planetarium. The public shows—conducted on Friday nights at 7 and 8—are distinct presentations individually created and delivered by the student members of the society.

"Different people write their own shows and give them," Bush said. "Everybody comes up with one of their favorite topics and then puts together a presentation."

This allows for literally a different presentation every Friday. Tickets for these public shows are $2, and to date nearly every show in the 119-seat planetarium has been sold out. Just don't go expecting a laser light show or entertainment package like those made popular at public planetariums.

"It's a different take on things than you get in the public planetariums that are designed primarily for public shows and public entertainment because there is a different mission her," Lawler said. "We're not in competition with, for example, Clark Planetarium (in Sale Lake City). That's a completely different purpose, with a completely different style of projector. And if you go to Clark Planetarium, they're not going to sit there and lecture you on where nebulas come from and how they were formed. They're going to have a really nice packaged show that they play . . . But it's designed more around entertainment with a science twist than it is around education with an entertainment twist."

Because BYU's planetarium serves as a classroom and lecture hall for astronomy students, professors sought a remedy to the typical acoustic problems that arise in domed facilities, such as distracting echoes and distorted sound.

"Any time you have a domed structure, you get focusing of sound and a whispering gallery effect—sound creeps along the dome and ends up on the other side, concentrating the sound in the middle," said Timothy Leishman, an assistant professor of physics who designed the planetarium's acoustics. "We used a new type of treatment on the dome—it looks like plaster, but it has very fine pores. A good portion of the sound works itself into the pores and gets absorbed by insulation. It's also a very nice projection surface."

BYU is apparently the first to use such a surface in a planetarium.

"To the best of my knowledge," Lawler said, "we're the only planetarium in the entire world that has a soft-plaster dome."

And while the inventive acoustics may boldly take BYU's enterprise where no planetarium has gone before, it is man's—and woman's—continued fascination with the heavens and their individual place in the universe that remains the driving force behind interest in astronomy.

"We're here on the surface of the Earth, and we look up and half of what we see is the heavens," Moody said. "And even though we don't visit there, it's home. I think everybody wants to understand better about where we live and what it's like. We all know about DNA and we all have DNA, but you don't see DNA every day. And most scientific disciplines are similar to that—the real exciting aspects are hidden from our view. That's not so with astronomy. The exciting aspects of it are there every night as a reminder."

And the planetarium provides an initial portal into satisfying those questions.

"It's one of those things about luring people into astronomy by making it very easy and convenient," Lawler said. "You can go to the planetarium, you can sit back in the chairs, you lean back, you look up at the dome and we'll show you all of the things. The next thing you know, you're sitting up at 2 o'clock in the morning with a telescope in the dead of winter when it's 30 degrees outside—and thinking you're having fun. But it's because we lured you into it with a nice comfortable planetarium."

"You can go to the planetarium, you can sit back in the chairs, you lean back, you look up at the dome and we'll show you all of the things. The next thing you know, you're sitting up at 2 o'clock in the morning with a telescope in the dead of winter when it's 30 degrees outside—and thinking you're having fun."

Jeannette Lawler
director of the planetarium

Stats institute meets this week

By Chelon Dyal

June 13, 2005

BYU statisticians will gather for the 30th Annual Summer Institute of Applied Statistics Wednesday through Friday.

This year's topic, "Practical Bayesian Non-Parametric and Semi-Parametric Modeling," features prominent statistician speakers Thanasis Kottas and David Draper from the University of California-Santa Cruz.

Bayesian methods are a way of statistical thinking, and Bayesian non-parametrics are a broad class of Bayesian models applicable to many different statistical areas. This course will provide an introduction to the Bayesian methods of statistics.

Although the summer institute was primarily created for the faculty, department secretary Kathi Carter said it was expanded through the years to become an open enrollment.

So far this year, almost 40 participants outside the faculty have registered for the summer institute.

BYU professor Gilbert Fellingham, who organized the theme and speaker for the event, said the topics are chosen each year to allow faculty to stay current on developing trends and current disciplines.

This will be the second summer institute course taught by Draper on Bayesian methods. The first course was an introduction to the Bayesian theories.

"If you look back in the past 30 years you'll see that we have had some of the big names in statistics come and speak for us," Fellingham said. "We have been very fortunate that those we've invited have wanted to participate."

Next year's summer institute will be on the topic of Wavelet theories. Todd Ogden from Columbia University has already accepted the invitation to speak.

Registration information can be found in room 230 TMCB, or by calling 422-4506.

Geology gets oil tech donation

By David Calkins

April 8, 2005

The Geology Department has received a donation of more than $5 million in exploration technology designated for student use.

The donation, announced Thursday, came from two companies in the form of a dataset and software that gives users a three-dimensional seismic visualization of the earth's subsurface.

Wind River Resources an oil and gas research company, provided the department with a seismic dataset collected in the southern part of the Uintah basin.

The data can be accessed and explored in 3-D using software donated from Land Mark Graphics, an oil and gas software developer. By projecting the dataset onto a screen, users wearing 3-D glasses are able to fully explore the rock beneath the earth's surface.

"This is the newest technology in oil and gas exploration," says Thomas Morris, professor of geology. "It's one of the greatest geological technologies developed in the past 10 years."

Wind River CEO Tom Bachtell said the technology helps conserve the environment.

"[The technology will] prevent the drilling of unnecessary wells," he said. "That's very important."

With this technology, BYU's geology students looking to work in the petroleum industry find themselves competitively placed at the top of the county.

"There's probably 10 universities that I'm aware of in the country that have such visualization center," Morris said. "The word is, with our projectors and our software, we're going to have one of the very best systems in the country."

The demand is high for students who can use and interpret data from a 3-D visualization lab, Morris said.

"Every oil company now has numerous visualization laboratories in their exploration companies," he said. "It helps everybody work as a team—it's much more efficient."

Morris said he's already seen students benefit from the donation.

"In the past two decades, we've had only two oil companies recruit our students," he said. "But now, with our 3-D visualization lab, we've received recruiting commitments from two additional companies."

Geology students using the technology will experience a smaller learning curve in the job market, Morris said.

"Our students will be at the cutting edge of exploration technology," he said. "They're going to have a jumpstart on their competitors.

BYU Department Chair of Geology Dr. Jeffrey Keith looks on as a representative from Land Mark Graphics puts the final signatures on donations totaling nearly $5 million for exploration technology re-

Protein powers up

By Chelon Dyal

June 14, 2005

BYU biochemists have made a breakthrough in understanding how cells in the body make the components that receive and carry out instructions from medications.

These components, called G proteins, are vital in the function of many hormones and nerotransmitters. Experts say understanding how they work opens a realm of potential medical answers.

The researchers found the method by which the cell assembles the subunits of G proteins together into a functional protein complex. This fundamental finding is published in the June issue of the Journal of the European Molecular Biology Organization.

Barry Willardson, a professor of biochemistry, said these findings have potential to influence the medical world.

"Once you know how the cell works, you have many different options for treatments of disease," Willardson said.

Each cell has receptors embedded in its membrane that detect the presence of hormones, neurotransmitters and many other substances.

When the receptor finds a hormone, it activates the G protein complex inside the cell and the G protein shuttles the information to enzymes and ion channels that determine the cellular response to the hormone.

These G protein-coupled receptors are the target of nearly half of the pharmaceuticals, said lead investigator Willardson. A few that Willardson named include morphine for pain, Prozac for depression, Claritin for allergies and Tagamet for indigestion.

"For years scientists have wondered how the G protein complex formed," Willardson said. "We showed that a cellular component called phosducin-like protein (PhLP) plays an essential role in this process.

Scientists knew PhLP was involved in the G protein assembly process but weren't sure how. They originally thought it acted as an inhibitor, preventing the signaling.

After 12 years of study, Willardson now things PhLP stabilizes the subunits of G protein, allowing them to mesh together.

Barry Willardson oversees Georgi Lukov in his lab in the Benson building. As part of his PhD thesis project, Lukov has played an important role in discoveries about G. proteins.

Georgi Lukov, a BYU graduate student, works on the research team under Willardson. Lukov said this finding is the beginning of many more potential understandings about cell functions.

"Now that we now this function of PhLP, other things can be studied," Lukov said.

"We can now try to solve the questions of how and what are the regulatory mechanisms in all of this. It is the first step and that is exciting.

Members of the BYU geology team dig up bones from a sauropod at the Dinosaur National Monument in Vernal

Y students study dinos

BYU's sauropod skulls one of a kind

By Chelon Dyal

June 8, 2005

BYU is in possession of four rare and ancient artifacts: skulls of Cretaceous-era sauropods, dinosaurs with long necks and tails, and small heads.

These skulls are so rare that the four BYU has are the only uncovered Cretaceous sauropod skulls existing in North America, said Brooks Britt, assistant professor of geology.

The head of the sauropod was only connected to the vertebral column by one small vertebra. When the animal died, the head would usually fall off and come apart because the bones of the skull were not fused together, making complete sauropod skulls hard to come by, Britt said.

"You can't just go around comparing skull to skull because they don't exist," Britt said.

Now BYU has two complete skulls and two partial skulls to study. The only other sauropod skulls found in North America had been from the Jurassic period. A previous era.

The bones were extracted last summer from a quarry at the Dinosaur National Monument located on the Utah-Colorado border, 20 miles outside of Vernal. The paleontologist team enlisted help from BYU to chisel out the bones.

A portion of the rock was removed from the quarry to be taken to BYU. Britt said it was about 7 feet long, 4 feet wide and 3 feet thick. The slab of rock and embedded bones was transported to BYU in a truck, where the team got started on the painstaking process of removing the rock.

"We knew there was a skull because we could see the teeth," Britt said. "And sure enough, there was a complete skull preserved in the rock. Then we found another skull in the same rock."

The four skulls, all found close to each other at the quarry, are now being studied to determine what group of sauropods they belong to.

"We know it doesn't match any other skulls that have been described," Britt said.

The skulls are all the same type, but it is a new species and genera.

"We're really lucky we have skulls," Britt said, "but we also have neck and tail vertebrae. Those will help us find out what group these belong to."

Britt's team of students have worked for a year to clean up and study the bones, including categorization. Anne Dangerfield, a BYU senior majoring in geology, has been heavily involved in the process.

"It is exciting to have possession of something so rare and to find the number of skulls that we did," Dangerfield said. "Having them in our collection to study is exciting."

Britt, who has been digging up dinosaurs since he was 14 year old, is looking forward to what can be learned from the skulls.

"Here we're looking at material that no on'e ever seen before, taking it out of the rock and putting it together and trying to figure out how it relates to other organisms," he said. "That's a kick."

Student News

Computer Science

Morgan Quigley

Morgan was recently awarded a National Defense Science and Engineering Graduate Fellowship. He will be doing his graduate work at Stanford, but qualified for the fellowship because of his excellent work as an undergrad with Michael Goodrich.

Moriah McClanahan

Moriah, an undergraduate student, received a $10,000 scholarship from Google. She is a TA for Cory Barker.

Kristine Perry

Kristine, one of Tony Martinez's graduate students, has received an NSF fellowship.

Statistics

Carly Pendleton

Shane Reese's student, Carly Pendleton, has been awarded the prestigious Gertrude Cox Scholarship. Along with a certificate, she will receive a $1,000.00 cash prize.

The Gertrude Cox Scholarship is awarded each year to encourage women to enter statistically oriented professions. The ASA Committee on Women in Statistics and the Caucus for Women in Statistics sponsor the scholarship. This is the second time a student from BYU has received the award. Kristen Piggott Shepherd received it in 2002.

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