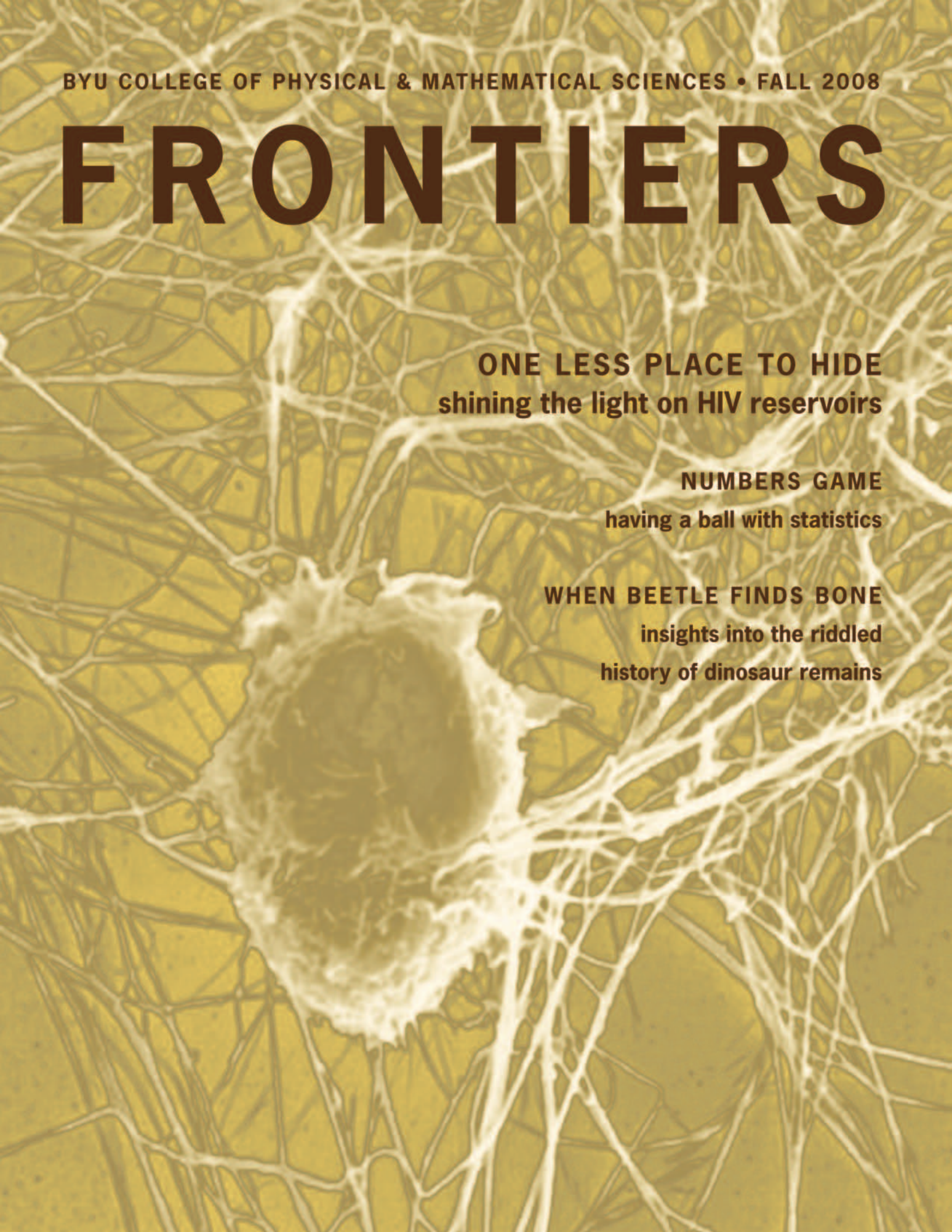
BYU COLLEGE OF PHYSICAL & MATHEMATICAL SCIENCES • FALL 2008

FRONTIERS



ONE LESS PLACE TO HIDE
shining the light on HIV reservoirs

NUMBERS GAME
having a ball with statistics

WHEN BEETLE FINDS BONE
insights into the riddled history of dinosaur remains

DEAN'S MESSAGE

As I write this in late August, I can feel excitement in the air. Soon the campus will be swarming with 32,000 students, and faculty members will be walking into their first classes of the fall semester. Regardless of how many times they've done this, each will feel a bit of anxiety – Will this be a "good" class? Will the students work hard? Am I well prepared? By the time you receive this issue of *Frontiers*, we will be nearly halfway through the semester, and the atmosphere of anticipation engendered by the arrival of the students will have been replaced by another sort of excitement.

By mid-semester, both students and teachers are thoroughly engaged in their classes, student wards and stakes are in full swing, and all sorts of activities are going on around campus. By mid-semester, students newly involved in mentored learning experiences are beginning to see their projects take shape and maybe even see some early results. Mentored students who started earlier in the year may be seeing final results. Others may be preparing to submit a manuscript to a scientific or mathematics journal.

If you're new to *Frontiers*, mentored learning is the chance for undergraduates to work with faculty and graduate students outside the classroom on real research projects. By putting to use in the lab what they've learned in the classroom, these students acquire additional tools and discover how effective "learning by doing" can be.

And effective it is. Over a third of the scientific papers published last year in our college had undergraduate student co-authors. Some of those students were listed as first author. Mentored student learning won't show up on a transcript, but its fruits will stand out on a resume sent with an employment or graduate school application. Graduates with mentored learning experience not only know concepts from their classes, they know something about how science and mathematics are done.

We allocate a substantial amount of our budget to wages for mentored undergraduate students, so they can earn money doing research rather than working in jobs unrelated to their interests. However, our budgeted funds are not sufficient to support all students who want to do research. We depend on donations from alumni and friends to extend this opportunity to more and more students. If you would like to help, please see the back cover of this issue to learn how.

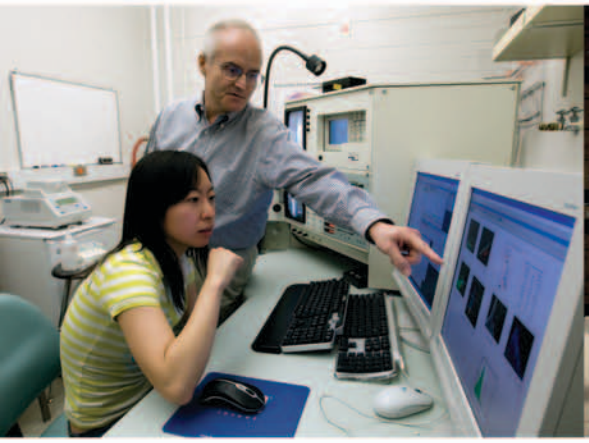
With this issue we welcome Gregory and Janet Taggart to the *Frontiers* team. They are owners of OstlerJameson Publishing and are working with us on stories, graphics, and the production of this magazine. As always, we welcome your comments on the content and other aspects of the magazine.

In this issue we feature work done in the Department of Chemistry and Biochemistry, the Department of Geological Sciences, and the Department of Statistics – all involving students mentored by our faculty, by the way. Some of these students have gone on to other opportunities, but they credit their work here with opening doors for them. Topics in this issue range from trying to corner the elusive HIV virus to solving an ancient mystery about missing dinosaur bone to analyzing what makes a winning sports team. We hope you enjoy it.

- Scott D. Sommerfeldt

FRONTIERS

FALL 2008



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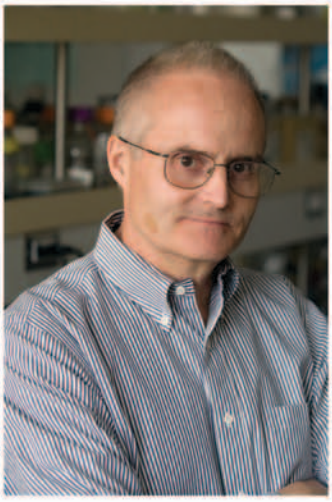
one less place to HIDE

by Gregory Taggart

Among the many headlines of May 14, 2008, one stood out, particularly if you or someone you know is infected with HIV: "BYU Researchers Help Find Cell Harboring HIV." A cure for AIDS remains unknown, but the finding by BYU and Johns Hopkins research scientists—that follicular dendritic cells or FDC, act as reservoirs, protecting the deadly HIV virus—is a significant step in that direction. The *Journal of Virology* published their research in its June 2008 issue. "Next we want to know if what's on the FDC in one tissue site in an individual is the same or different than what's on another FDC in a different spot," says chemistry Professor Gregory F. Burton.

Co-authors on the groundbreaking paper include graduate students Brandon F. Keele, Jacob D. Estes, and Tyler C. Thacker, as well as Trever Burgon, an undergraduate. Professor Keith Crandall and post-doctoral fellow Loubna Tazi of the Biology Department provided expertise with the evolution of HIV. The BYU group worked jointly with a group from Johns Hopkins University's Department of Neurology that included Professor Suzanne Gartner, an HIV virologist, among others. "Because BYU is not a medical school and doesn't have access to patient populations, Johns Hopkins' cooperation was essential for us to gain access to patient material to do what we did," Burton explains.

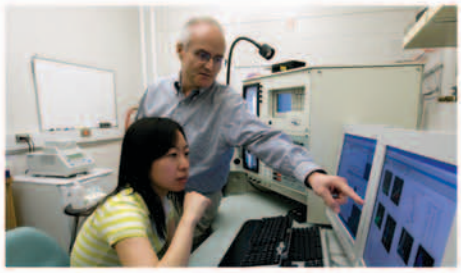


LEFT: Chemistry Professor Gregory Burton in his lab at BYU. [PHOTO BY JAREN WILKEY/© BYU PHOTO 2008 ALL RIGHTS RESERVED.] RIGHT: Professor Keith Crandall of BYU's Department of Biology provided expertise on the evolution of HIV.

And as far as Burton is concerned, so was the involvement of four students in his research. A quality research program makes it possible for the College to fulfill its mission to teach both graduate and undergraduate students. Mentored research opportunities get students away from their books and into the lab where they learn the techniques of actual research. In Burton's project, students isolated RNA and DNA from specific cells obtained from HIV patients, participated in the intellectual discussions about the results, and helped plan the experiments. "For me, the payoff in working with students is that I get to see the lights turn on in their minds, and that's terribly rewarding," Burton says.

The Mysterious Cell

Rewarding as well, is the research that turns that light on. In this case, it was research into a cellular mechanism important to us in maintaining our immunity to tetanus or other diseases. What's strange is that that same mechanism acts as an obstacle to a cure for AIDS, according to Burton. That is, when an HIV virus sits on the surface of an FDC cell, it remains infectious, "even if it is surrounded by very high levels of neutralizing antibodies that would otherwise prevent that virus from causing infection."



Dr. Burton enjoys mentoring students like graduate student Changna Wang in his lab. [PHOTO BY JAREN WILKEY/© BYU PHOTO 2008 ALL RIGHTS RESERVED]

To understand why, it helps to know how FDC cells prolong the life of a tetanus shot so that you won't need a booster shot for another 10 years or so. Surprisingly, most of the material or antigens that the doctor injects into you when she sticks the needle in your arm or backside clear out of your body in about three days. However, FDC cells reach out with their long, octopus-like tentacles and trap the rest of the injected antigens on the cell in very small quantities. Then, as needed, the FDC cells release some of the trapped material to stimulate your immune system to produce antibodies to fight disease. "In other words FDC cells act much like a thermostat," Burton explains. "When the temperature drops, the heat kicks on; when antibody levels drop too low, this cell releases little bits of the material from the shot, stimulating the production of antibodies again."

That's the good news. The bad news is that FDC cells also apparently trap the HIV virus, where it sits infectious and protected from even high levels of neutralizing antibodies, able to infect other cells. "In other words, an FDC cell treats the HIV virus as it would any other material that comes into the body," Burton says. "It traps it and holds it on its surface. In essence, the virus tricks the cell."

Reservoirs of Trouble

AIDS researchers call such sites reservoirs, places in the body that collect the HIV virus and protect it from both the body's immune system and from drug treatment. In the early 80s, everyone knew that FDCs were major sites of virus accumulation; however, they didn't understand the consequences of that accumulation. So when the potent drug treatments of the early to mid-90s came along, treatments that seemed very effective in treating infected persons, the medical community began talking about a cure for AIDS. "They did calculations and estimated that if they kept people on the drugs for three or four years, all the virus would be cleared out of the body, and the infected individual would be cured," Burton explains. "What happened, however, is that within 14 days after they stopped the drugs, the virus was back to the level it was at prior to the drug treatment."

> FOLLICULAR DENDRITIC CELLS ACT AS RESERVOIRS, PROTECTING THE DEADLY HIV VIRUS

In the end, researchers realized that reservoirs stood in the way of a cure. They identified or characterized two: macrophages and CD4+ T cells. They suspected that FDCs represented a third, but until Dr. Burton's team stepped up to the plate, it was only a suspicion; it had not been proven. "And that's what our work addressed," he says.

Reservoirs are defined by three characteristics: They must harbor or possess infectious viruses, the viruses in the reservoir must be genetically diverse, and finally, they must have examples of so-called archived viruses. "This simply means that examples of the virus were present early on and then disappeared from other sites in the body, but because they've been harbored in this room, if you will, they still exist," Burton explains. "If we find them in this room or reservoir, it indicates that the cell is pulling out viruses over time."

Ultimately, Burton and his colleagues were able to prove that FDC cells met the three criteria, and now there are three recognized reservoirs. "HIV is a terribly tricky beast," says Brandon Keele, now an assistant professor at the University of Alabama at Birmingham Department of Medicine. "Hopefully with this new information, we can find ways to eliminate viral reservoirs and thus infection all together." And who knows, maybe among the scientists who finally do that will be a former student who acquired his research skills in Dr. Burton's mentored lab. ■

OPPOSITE and COVER: Electron micrograph of an isolated Follicular Dendritic Cell cultured on collagen, courtesy of Dr. Andras K. Szakal.

NUMB3RS GAME

by Vanessa Stanfill

You can tell Garritt Page is one of those guys who knows all the stats. Name a team, a coach, a player, and he can break it down for you. Even when he was small, he says, the numbers behind sports fascinated him. So when, as an undergraduate student studying mathematics at Southern Utah University, he heard Professor Gil Fellingham speak about the opportunities in statistics at BYU, he knew he had found the graduate program for him. Not only did statistics in general appeal to him, he couldn't resist the idea of a thesis that combined his two passions: mathematics and sports.

A Winning Combination

BYU's Department of Statistics has two professors whose interests have helped introduce an innovative combination of sports and statistics to the world of academia. Dr. Fellingham, a former high school athletics coach, and colleague Dr. Shane Reese begin their sports research right on the court, measuring plays and counting touches of the ball. For them, sports is a statistical playground where methodology meets recreation. Over the years, they have applied their statistical skills to both college and professional athletic teams. They even helped prepare the U.S. National Men's Volleyball team for the 2004 Olympics. In that case, they used statistics to help a scattered group of players optimize their limited practice time and pull together as a team. As a result, the team astonished the world as they rocketed from an entry ranking of 14th to an impressive 4th place finish.

Though athletic competition has traditionally generated an astonishing volume of data, statisticians have only recently taken sports number-crunching seriously. In 2004, the first peer-reviewed journal of athletics and statistics, the *Journal for Quantitative Analysis in Sports* (JQAS), lent some academic rigor and legitimacy to the historically slighted area. Today statisticians like Fellingham and Reese use their computer models to help teams find how best to use practice time to develop the most valuable skills. The statistics their models generate go far beyond the familiar batting averages and field goal stats you find on the sports page and make it possible for coaches and players to find out exactly where they should place their focus for maximal results. "What you measure you value, and if you're measuring the wrong things, you will value the wrong things," Fellingham says.

Dr. Gilbert Fellingham (left) and Dr. Shane Reese (right) combined their interest in sports with their expertise in statistics to show teams how to maximize their practice time and use their personnel more effectively.

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TEAMWORK TRUMPS HAVING ONE OR TWO PLAYERS THAT DOMINATE COURT ACTION

The professors' forays into the world of college and professional sports have helped in the classroom as well. Usually, involving students in meaningful research presents an almost insurmountable challenge because the math and computer programming skills essential for real statistical work is often far beyond undergraduate and even most master's students' abilities. But sports captures students' enthusiasm unlike any other statistics topic. So when sports are involved, a few unusually motivated students will go out and learn the necessary math and computational techniques on their own, just so they can be involved in the research. By playing to that interest, Professors Fellingham and Reese discovered, their sports projects provide excellent opportunities for these students to develop serious methodological skills.

Garritt Page's thesis examines individual playing positions in the NBA, using Bayesian statistical analysis.

What Box Scores are For

Driven by his love of sports and statistics, Garritt Page took advantage of that opportunity. He knew he wanted his thesis project to involve basketball and statistics, so he approached Professor Fellingham about the possibilities. Guided by both Fellingham and Reese, Page narrowed his focus to an examination of individual playing positions in the NBA. They then spent months simply coming up with a model for his thesis. They finally settled upon a Bayesian hierarchical model that allows researchers to separate out the individual value of each player or skill by using parameters assigned to each position and play.

Next, Page collected box scores—a summary of the individual performance of players in a basketball game—for 1,163 games from the NBA's 1996-1997 season. The parameters allowed him to untangle the complex dynamics of team play and tease out specific information from the box scores. Thus armed with a more comprehensive record of each player, position, and performance, he and his mentors used their model to draw a statistical image of what positions and skills are most important to an NBA team.

In every case, their research shows, teams perform best when individual players work together. For instance, rather than field goals, assists lead to the most overall points. Small forwards who pass the ball to set up plays are more valuable to their teams than even high-visibility power forwards. In short, teamwork trumps having one or two people on the court who dominate the action. Page points out that back in 1996, basketball was very much a big star game, with players feeding the ball to one central scorer. Since then, NBA strategy has moved in the direction of a more free-form offense, with a focus on team play. "The NBA has actually evolved towards what our study was showing," he says, "I think that is pretty cool."

Rewards of a Job Well Done

Page and his professors reported their findings in the JQAS in 2004, with Page as lead author. Published paper in hand and an unusual amount of experience under his belt, Page is now pursuing a Ph.D. in statistics at Iowa State University. He wasn't the only one to benefit from his NBA project. Such papers enhance the Statistics Department's reputation for turning out outstanding graduate students. The study also generated interest outside the academic world. Thus, articles published about Page's research in magazines and newspapers have allowed statisticians to reach out to the average reader who may not be interested in Bayesian hierarchical methodology, but who is fascinated by an academic approach to NBA strategy.

After earning his Ph.D., Page hopes to pursue a career in academia, but he hasn't crossed other potential career options off his list just yet. Studies like his have begun attracting the attention of professional sports as coaches realize that sophisticated statistics applied to their sport can give their team a competitive advantage. For example, the Oakland A's used quantitative data to shape a better team on a smaller payroll. Similarly, the Boston Red Sox turned a so-so team into a powerhouse.

As a result, a new career option is available to statisticians. In fact, after he performed some statistical work for the Philadelphia Eagles, the team offered Professor Reese a job as the team statistician. Since the job offer required work on Sundays, Reese declined. Odds are, Page can look forward to similar job opportunities. But whether he ends up as a professor in the classroom or as a statistician on the sidelines, he looks forward to the day when he can, as he puts it, "spend some brain cells thinking about sports stuff." Now, that's academic.■

Insights into the Riddled History of Dinosaur Remains

BY MARY EYRING

[PHOTOS BY MARK PHILBRICK/ © BYU PHOTO 2008 ALL RIGHTS RESERVED]

Anne Dangerfield, a master's student in BYU's Department of Geology, found that dinosaur bones deposited in the earth approximately 148 million years ago can still yield up fresh secrets. The 23-year-old native of Green Bay, Wisconsin, began studying dinosaur bones as an undergraduate at BYU. With her faculty mentor, Professor Brooks Britt, she asked probing questions about the pits and furrows etched into the bones, disfigurements conventionally attributed to unknown insects or even algae. What she found shed new light on the prehistoric past and made her more attractive to employers in the future.

Geologists have long noticed dinosaur bones riddled with such marks and observed that entire pieces of the bone – particularly the ends – may be missing, but both Britt and Dangerfield were determined to find out why. Although the mystery baffled other scientists, it piqued Dangerfield's interest. "What caught my attention was that these insect traces have been noticed and documented on dinosaur bone for years, but nobody knew what they were," she says.

Graduate student Anne Dangerfield found a rich array of furrows and pits in the dinosaur bones she studied.

As she worked with Britt to compile research on a related topic, Dangerfield made a significant discovery. The two had previously found that bone-eating termites left marks now apparent on dinosaur fossils, a valuable insight in itself. So when Dangerfield turned her attention to a *Camptosaurus* bone, she expected her findings to support this conclusion. Although Britt had looked at the specimen before, Dangerfield noticed tiny holes in the bone, holes that termites could not have made. An in-depth examination of the bone, Britt says, "revealed the rich array of traces, furrows and pits on the ends of these bones, and we realized that this is a whole new ball game. The microscopic traces in the bottoms of the pits only matched one of all the insects we'd studied, and that was the dermestid beetle." After that, he said, "The size, the shape, and the morphology and everything just fell into place."

Based on their scrutiny of the bones, Dangerfield and Britt constructed a vivid picture of the circumstances that affected one dinosaur's remains. Some 148 million years ago, adult dermestid beetles, attracted to the carcass of an adolescent *Camptosaurus* dinosaur decomposing on the soil of what is now Medicine Bow, Wyoming, deposited eggs onto the body. Some of these eggs hatched into tiny larvae that gorged themselves on the dinosaur's decaying flesh and then bored into the nutrient-rich bone. Dangerfield and Britt can point to the furrows within the surviving bone as evidence that the larvae also consumed the marrow-filled interior of the bones before their wings became mature enough to transport them to a different food source.

Although Dangerfield traveled to various locations to study thousands of dinosaur bones, she found the key to unraveling the mystery

SOME 148 MILLION YEARS AGO, ADULT DERMESTID BEETLES, DEPOSITED EGGS ONTO THE BODY OF AN ADOLESCENT CAMPTOSAURUS

of pockmarked bones right under her nose – in BYU's Earth Science Museum. "She was going to museums in places like Montana and Minnesota to look at their collections, trying to gather information on what we were interpreting as termite traces on bones," Britt says, "but finally in our own museum we found one that was clearly different than all the rest, and that became a paper."

Not only did Dangerfield personally collect research on a project unparalleled in its scope – "I don't know of any other insect trace fossil study that has looked at over 5,000 dinosaur bones or investigated so many types of bone-eating insects," she says – she helped to author a number of papers, including one published in May in the journal *Ichnos*.

Dangerfield cites these experiences as unique preparation for both graduate school and life beyond. "The undergraduate program gave me experience doing research, making presentations, writing technical papers and grants, and working in teams with other scientists," she says.

THE RESEARCH EXPERIENCE I GOT AT BYU SET ME APART FROM OTHER JOB CANDIDATES

According to Professor Brooks Britt, the key to the mystery of the pockmarked bones was in BYU's Earth Science Museum.

"Many of the projects I've worked on have been or are in the process of being published, and these experiences were a huge advantage during my graduate work. I didn't have to learn how to research; I could just do it."

Dangerfield's extensive participation in hands-on projects gave her a boost as she set her sights on an attractive position in an unusually competitive job market. In August, she will leave BYU with a master's degree to assume a position at Exxon Mobil, an opportunity she attributes to her undergraduate and graduate training. "The research experience I got at BYU set me apart from other candidates," she says. "It also gave me confidence as a geologist, and that is something employers want to see."

Dangerfield points to one of the furrows in the bones she studied.

According to Britt, Dangerfield's success represents a win-win situation for faculty and students. Before he left BYU to pursue a Ph.D. at the University of Calgary, Britt enjoyed similar one-on-one attention from his professors, gaining training and forging professional relationships that made him feel "like the luckiest guy in the world. Now, many of the projects I work on I wouldn't even be able to get done without the help of students like Anne. She's an integral part of the whole thing, from finding critical points, critical specimens, and everything. It just works out for everyone," he says. "And when she interviewed for jobs, her experience set her apart. She had done work as an undergraduate that usually isn't done until graduate school, and that really made her shine."

For her part, Dangerfield was glad to assist Britt with his research, and even grateful to be sent around the country on her own to collect and analyze data. "Dr. Britt encouraged me to learn everything I could about the fields of paleontology and geology. He trusted me with a lot of responsibility, which immeasurably improved me as a scientist."

Their collaboration has proved beneficial in other ways as well. The scientific community is closer to determining when certain insects evolved and how the earth's climate has changed over time; Britt is even more willing to rely on students to collect important data; and Dangerfield has the opportunity to apply her training in a challenging new job. According to Britt, Dangerfield's experience highlights the unique advantages of BYU's approach to studying geology. "Anne's had a chance to see how research is done. Collaborating on projects like these is a great experience, one that works out well for everyone." ■

Doing Good by Doing Well

Ken and Athelia Woolley

You just know that when someone asked the inevitable question, "What are you going to do with a degree in physics?" Ken Woolley answered, "Everything!" The man has been that busy. Woolley graduated Valedictorian from BYU in 1969 with a B.A. in physics—yes, a B.A.—then moved on to Stanford business school to earn an MBA and a Ph.D. in business. "I was offered a National Science Foundation fellowship to pursue graduate studies in physics," he says. "However, I knew that my personality was such that I wasn't going to remain in a lab all of my life."

By 1972, he was working for the Boston Consulting Group in Massachusetts as a management consultant. Two years later, he was in Cody, Wyoming, working as a vice president and then as president of Y-Tex Corporation, a company that makes ear tags to identify cattle. Then in 1979, he moved back to Utah as an associate professor in what later became the Marriott School, teaching corporate strategy and real estate.

For most people, that would have been a lifetime of experience, but Woolley was just getting started. He has built 600 homes in Salt Lake Valley and 8,000 apartments in Las Vegas. He co-founded and took public the largest ice cream manufacturer in the United Kingdom. He has drilled for oil in Wyoming. Even as he moved from Wyoming to Utah, he was starting Extra Space Storage, Inc., a self-storage development company that he now calls his "full-time job."

Almost 30 years later, Extra Space owns 270 properties outright and manages another 410 in 34 states and the District of Columbia. The company trades on the New York Stock Exchange, employs 2,000 people, and has a market capitalization of $1.3 billion. "When we went public in 2004, we raised $290 million," Woolley says. "At that time, it was the largest public offering ever done in Utah."

Woolley's entrepreneurial ways have allowed him to pursue other interests as well. He is particularly interested in archeology and spent considerable time on digs in Guatemala with BYU's Anthropology Department. For the last 10 years, he's helped fund the excavation of the Piedras Negras site. He also serves on the board of the Global Heritage Fund, an archeological foundation based in Palo Alto that sponsors archeological efforts in underdeveloped countries to promote tourism. "If you develop a site, say in Vietnam or Lybia, and make it appealing to people, then you help the local economy as well as preserve the country's heritage," he says.

That same generous spirit has made Woolley an important friend to the College of Physical and Mathematical Sciences, thanks in part to his undergraduate experience with Professor Daniel Decker, his major professor. "He's retired now, but he had a great influence on me. I worked as his research assistant in high-pressure physics."

So that other students can have a similar experience, Woolley provides support to the undergraduate mentoring program in the College, where students can learn how to research and prepare themselves for graduate school. "I have a great love for what I learned at BYU in the Physics Department," he says. "Getting close to a professor like Dr. Decker was motivating."

Woolley and his wife, the former Athelia Tanner, have five daughters and two sons, and 13 grandchildren. He has served as a Bishop, High Councilor, Gospel Doctrine teacher, and Young Men's President, "There are a lot rewards in helping other people," he says. Mentored students are sure to agree.■

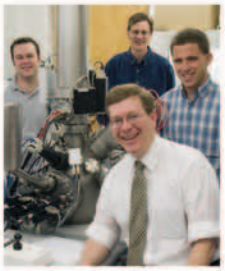
CLASS NOTES

Outstanding TAs Reap Their Rewards

In June five students in the Department of Physics and Astronomy received the 2008 Outstanding Teaching Assistant of the Year award from the American Association of Physics Teachers. For their efforts, Dave Baxter, Xi Chen, John Harrison, Bailey Hsu, and Craig Swenson received membership in the AAPT, a year's subscription to *Physics Today*, their choice of either the *American Journal of Physics* or *The Physics Teacher*, and a certificate in recognition of their superb work in the physics classroom.

The Presses Stop for Biochemistry Undergrad

Robert Blake, a recent graduate in biochemistry, is first author on a paper in the journal *Macromolecular Rapid Communications*. While it is not unusual for undergraduates to co-author publications in the scientific literature, Blake's paper describing the growth of polymer thin films received a little extra recognition. The editors called attention to the significance of the work by featuring artwork from the paper on the cover of the August 2008 issue of the journal. Currently a medical student at Baylor, Blake worked under the direction of Professor Matt Linford while at BYU.



Clockwise from the left, Tony Pearson, Professor Adam Woolley, Hirum Connley, and Professor Matthew R. Linford.

From Kathmandu to Microsoft Scholar

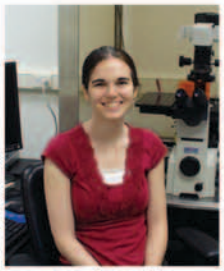
Sambridi Gautam, a sophomore in computer science, has been selected as a Microsoft Scholar. Each year, Microsoft awards scholarships to a select group of the best and brightest computer science students from the United States, Mexico, and Canada. The prestigious award covers all tuition costs for an entire year. Originally from Kathmandu, Nepal, Gautam transferred to BYU after a semester at Southern Arkansas University.As a new BYU student, she planned on majoring in either physics or astronomy; however, a first-semester computer science course changed all that. Now Gautman focuses her attention on software engineering and computer graphics rather than on the stars.

A Professor of (NSA) Distinction

The National Security Agency (NSA) recently named Dr. Sean Warnick its 2008 Distinguished Visiting Professor. The position is highly competitive and is offered to a professor with a distinguished record in both decision science applications and student mentoring. Dr. Warnick, an assistant professor in the Computer Science Department, received his Ph.D. from MIT in 2003 in electrical engineering and computer science, with a minor in mathematics. His work focuses on the feedback control of complex dynamical systems; with applications, including proteomic network reconstruction; scheduling of batch manufacturing systems; and market power/valuation analyses in merger-and-acquisition studies.

Thanks for the Helping Hand

Marian Adamson, who graduated with a B.S. in physics last year and is pursuing a Ph.D. at the University of Michigan, recently received a prestigious National Science Foundation Graduate Fellowship. In a letter to the BYU Department of Physics and Astronomy, she expressed thanks for the opportunity to do research as an undergraduate through undergraduate mentoring. She said that she felt the head start on research helped her win the award.



Her research advisor at BYU was Professor R. Steven Turley, who helped her put in final form work she did with Dr. Steve Rehse of Wayne State University.

Anyway You Do the Math

According to the Institute of International Education, the BYU Department of Mathematics has received more Fulbright Awards than any other mathematics department in the nation over the last eight years. In fact, in the past three years, BYU math professors won 3 of the 18 Fulbright Scholars awarded in the field of mathematics. Professors Gregory Connor, Wayne Barrett, and Michael Dorff were Fulbight Scholars in 2007, 2006, and 2005, respectively. Supported by the United States State Department, the Fulbright program customarily selects eight hundred top scholars and teachers each year from around the nation to teach and research in other countries.

Professor Wayne W. Barrett (left), Professor Michael Dorff with students Laura Cannon and Brian Rushton (right), and Professor Gregory R. Conner (top).

WHY DENTAL SCHOOLS ATE HIM UP.

Donations to the BYU Annual Fund supported grants that allowed David White to spend two years doing cell research in Dr. Barry Willardson's biochemistry lab. The mentored learning experience impressed four of the nation's top dental schools. Accepted at all of them, David chose UCLA, where he started this fall. We invite you to support our students through generous gifts to the BYU Annual Fund. And please remember to designate your gift to the College of Physical and Mathematical Sciences.

EVERY GIFT MATTERS

To talk about helping the college with a special gift, contact Brent Hall at 801-422-4501 *or email* brenth@byu.edu.

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