WELCOME to the LATEST ISSUE of RESEARCH.

Much has been written in previous issues concerning Baylor’s growing research infrastructure, and to be sure there is much to celebrate. However, new faculty arriving at Baylor find more than just buildings and equipment. They inherit the resource that has defined Baylor for generations: its students.

In this issue of Research, we highlight the creative endeavors being pursued by a small sample of Baylor faculty — a cross-section of chemists, nurses, engineers, scientists, musicians, artists and philosophers — and explore the relationships at their core — the relationships that make Baylor so special.

Across campus at the BRIC, we find the story of the mentoring relationship forged between a professor and student at the Colorado School of Mines and how it now is impacting advanced composites research within the School of Engineering & Computer Science. Another project finds undergraduates funded by Nova Biologicals, Inc. redesigning and building a product aimed at protecting one of our most precious natural resources — water — from nuclear, biological and chemical threats. Exhibiting the integrated paradigm that makes the BRIC so unique, the Nova team is also working with LAUNCH, the innovative technology accelerator within the BRIC that operates in cooperation with the Hankamer School of Business, to develop a business plan for global commercialization of the resulting product.

The list (as you’ll read) goes on. You will meet a Baylor art professor whose study of the surfaces around us moves his art into challenging new territories, and meet the dean of the Baylor Honors College who challenges students to develop critical thinking and writing skills through the study of classical literature and popular culture. You’ll read about the Green Scholars Initiative in Baylor’s Institute for the Studies of Religion, offering both professors and students alike the unparalleled opportunity for direct contact with primary texts. Finally, you will be introduced to professors within the School of Music who on a regular basis prepare students for the international stage.

As always, it’s my hope the stories in this issue of Research will provide you a glimpse into the array of scholarship marking the Baylor experience. More importantly, I trust you’ll also see a glimmer of the heart of that story — professors opening the door to their research and inviting undergraduate and graduate students to join them on the journey.

Baylor research making a difference — as always, the best is yet to come!

To learn more, please visit our websites at www.baylor.edu/research and www.baylor.edu/bric.
LOOKING BELOW THE SURFACE

TWO BAYLOR FACULTY MEMBERS ENHANCE our UNDERSTANDING of the WORLD AROUND US by starting at the SURFACE and LOOKING DEEPER.

At Baylor, the pursuit of knowledge takes many forms and moves in many directions. Faculty across the university use cutting-edge techniques to broaden the current state of knowledge and advance scholarly conversations in a variety of fields. While they ask different questions and seek different conclusions, they share an emphasis on producing work that expands the academic landscape while equipping their students to take the next steps in their careers.

With that broad range of faculty expertise, perhaps it’s not surprising that faculty members who work in seemingly unrelated fields can have research and creative agendas that begin in a similar place but use very different techniques.

Dr. Rebecca Sheesley, an assistant professor of environmental science in the College of Arts & Sciences, joined the Baylor faculty in 2010 after completing a postdoctoral fellowship at the Bert Bolin Centre for Climate Research in Stockholm, Sweden. Since arriving at Baylor, she has continued to develop an interdisciplinary research agenda focused on the origin and transport of air pollution.

Her specific focus is on particulate matter (PM), a complex mixture of tiny particles suspended in the atmosphere. Sheesley analyzes particles smaller than 2.5 micrometers in diameter, roughly one-thirtieth the size of a grain of sand. They can be emitted directly from sources as particles or formed in the atmosphere when gases react in the presence of sunlight. In addition to causing environmental damage, PM also has negative effects on human health. According to the Environmental Protection Agency, exposure to particle pollution can cause serious

“The collaboration gives us a lot of different resources to draw from.”
health problems including asthma, decreased lung function and heart attack.

While federal and state regulations on air quality give government and industry leaders an incentive to closely monitor particulate matter in the air, Sheesley says that just knowing how much PM is in the air is only half the story.

“Particulate matter can originate from anthropogenic—man-made—sources like auto exhaust and industrial emissions, but it can also be produced from biogenic—natural—sources as a product of gases given off by trees and other plants,” she says. “My research involves sampling the air at fixed locations and determining what percentage of suspended particles come from various sources.”

Since some sources of particulate matter are easier to regulate than others, Sheesley says, it’s essential to know how much of the pollution in a problem area is due to controllable human activity and how much is a result of natural processes. With so many potential sources of PM and the high likelihood of particles spreading over large areas, a collaborative approach is essential to fully understanding the pollution that exists in a particular region.

In a current research project funded by the Texas Commission on Environmental Quality, Sheesley is working with colleagues at the University of Texas and Rice University to study particulate matter conditions in Houston and the surrounding area. She says the combined expertise of faculty from all three universities helps provide a more nuanced understanding of pollution’s causes and potential solutions.

“The collaboration gives us a lot of different resources to draw from,” Sheesley says. “Baylor’s ground-based sampling equipment measures particulate matter levels at several sites throughout the Houston area which can then be analyzed for the percentage of anthropogenic versus biogenic particles using radiocarbon analysis and molecular tracers. Then, our collaborators at the University of Texas and Rice University use single-particle instruments to get detailed information on the temporal trends and chemical characterization of the particles. They also provide mobile sampling capabilities that give more detailed information on the particulate matter levels in between the fixed sites where our sampling equipment is located.”

Because of the health impacts that can result from exposure to particulate matter, Sheesley’s research is of great interest to state and local governments responsible for maintaining compliance with federal environmental guidelines.

“The measurements we make help us create a model that shows the effects created by various sources of emissions. That knowledge helps governments and industries make good decisions about what factors they can best control to reduce the impact of particulate matter on air quality.”

While a brisk wind whipping across a jagged, roughly formed geologic formation might inspire Sheesley to consider the rocks’ effect on the movement of suspended particles, that same scene inspires a different kind of intellectual response from Karl Umlauf, Baylor’s artist in residence and professor of art in the university’s College of Arts and Sciences.

Umlauf, an internationally known artist who has exhibited works of drawing, painting and sculpture around the world, has drawn inspiration from a variety of natural and industrial sources, including the distinctive geologic features he observed while growing up near the Balcones Fault Zone in the hill country of Central Texas. As a young child, he and his friends explored the caverns near his home, cultivating a passion for geology that has informed his career in art ever since.

“I began my art career with geological viewpoints of landscapes and rock formations,” says Umlauf. “The formations have lots of potential...
for abstraction, but they still maintain their own identity. I’ve always adjusted the formations to bring out certain aspects while allowing the landscapes to maintain their essential nature.”

Throughout his career, Umlauf has worked in a wide range of media allowing him to represent different attributes of the natural and industrial world from which he draws inspiration. Whether working in charcoal, metal, or even extruded fiberglass, Umlauf’s focus is on experimentation. He says having the freedom to experiment with new ideas and nontraditional media makes him both a better artist and a more effective teacher.

“As a working research artist, I can help my students learn to take risks and pursue ideas based on what historical and contemporary masters have given us. Ideally, a teacher should be an informational guidepost for his or her students and teach them to explore new ideas rather than just concentrate on producing art that will be commercially successful. I think my own experimentation makes me better prepared to help my students find new solutions to old problems.”

Umlauf says that working at Baylor has provided him the opportunity to remain active in the research that supports his art as well as his teaching.

“From the very beginning, the administration has been extremely supportive of my work, even when it was outside the more traditional work that you might expect to see at a place like Baylor. I’ve been able to explore the full spectrum of research, media, ideas and creative processes.”

“I began my art career with geological viewpoints of landscapes and rock formations. The formations have lots of potential for abstraction, but they still maintain their own identity.”
One of Farmer’s earliest challenges as department chairman involved recruiting a top researcher to fill the university’s Robert A. Welch Chair in Chemistry, held at the time by renowned British chemist, Dr. F. Gordon A. Stone, who was retiring after 20 years in the position. The author of more than 900 academic publications and recognized by the American Chemical Society as one of the world’s top chemists, Stone’s successor would have very large shoes to fill.

Farmer’s search quickly led him to Dr. John L. Wood, former Yale professor, holder of the A.I. Meyers Chair in Chemistry at Colorado State University and organic chemist of international regard. Graduating Summa Cum Laude with a B.A. in chemistry from the University of Colorado Boulder, Wood earned his doctorate in organic chemistry from the University of Pennsylvania in 1991 and subsequently completed an American Cancer Society postdoctoral fellowship at Harvard.

Wood was no stranger to Farmer or Baylor; he had spoken previously at one of the department’s colloquium events. He was more than a little surprised at what he found on that first trip to the campus.

“Prior to my first visit I didn’t know anything about Baylor; I didn’t even look it up on the Web before I came down to give the seminar,” Wood recalls. “I thought it was just going to be a small, undergraduate place. When I got here and I saw this facility (Baylor Sciences Building) I just thought, ‘Oh my, this is a much more impressive place than I imagined.’ Not long after I got back to Colorado, Dr. Farmer asked me if I would be interested in the Welch Chair. I said, ‘Sure, let’s find out more about it.’

But Wood was pretty happy where he was. “I grew up in Colorado, and Texas would be the last place in the world I ever thought I’d move to,” he laughs.

While Wood was mulling Farmer’s offer, one of Wood’s former students suggested that Farmer might be able to entice Wood to come to Baylor if he would write a proposal to the Cancer Prevention and Research Institute of Texas (CPRIT) naming Wood as the proposed principal investigator.

**THE ROBERT A. WELCH FOUNDATION (HOUSTON, TX)**

Is one of the oldest and largest private funding sources for chemistry research in the United States.

Provides funding to advance chemistry research in Texas institutions through grants, endowed chairs, visiting lectureships, and other special projects.

Baylor’s Welch Chair, established in 1965 and one of the first, is now among more than three dozen chairs around the state endowed by the foundation.
Knowing that the CPRIT program does about as much to help Texas institutions recruit top-notch, out-of-state researchers as Robert Griffin III’s Heisman Trophy did for Baylor’s football recruiting program, Farmer decided to give it a go. When CPRIT responded with a $4.2 million award, Wood pulled up stakes and headed for Waco.

Wood’s Baylor laboratory specializes in synthesizing small-molecule compounds derived from natural sources such as plants, animals or fungi. The compounds come to him from the scientists who isolate them, or from researchers who think a previously discovered natural compound merits further study, but can’t get enough to work with from the natural sources. His work has earned him favor with the biggest names in the pharmaceutical industry, where many of his former students go on to find productive and rewarding careers.

As big an incentive as the CPRIT grant was, it was only one consideration in Wood’s decision.

“I think the thing that really turned the tide for me was, this university’s administration was committed — seriously committed and putting their money where their mouth was — to improving Baylor’s stature in both research and collegiate athletics. As big an incentive as the CPRIT grant was, it was only one consideration in Wood’s decision. “That’s how science is done. You need other people to inspire you and to tell you when you’re doing it right and when you’re doing it wrong. As scientists in a particular area, we all work together,” Farmer observes. “Basic science is unusual in that way. People in directed or applied research are competing with each other and have to be very circumspect about letting others know about what they are doing. Basic researchers share things openly; they have to.” Farmer continues, “Science is science, and what comes out of it is usually not what you expect. Chemistry, in particular, is a kind of trade in which you can read all you want about how reactions of sulfur and oxygen happen, but until you are there, you see it, you start it and you smell it afterward, you don’t really understand it.” It’s that perspective that undergirds his belief that research experience is crucial for all students, but particularly undergraduates.

“Undergraduate research opportunities are particularly important for students who are going to medical school or into any other health profession, as well as for those wanting to be scientists. But it is equally important for the student who simply wants to know how the world works. “That’s how science is done. You need other people to inspire you and to tell you when you’re doing it right and when you’re doing it wrong. As scientists in a particular area, we all work together,” Farmer observes. “Basic science is unusual in that way. People in directed or applied research are competing with each other and have to be very circumspect about letting others know about what they are doing. Basic researchers share things openly; they have to.” Farmer continues, “Science is science, and what comes out of it is usually not what you expect. Chemistry, in particular, is a kind of trade in which you can read all you want about how reactions of sulfur and oxygen happen, but until you are there, you see it, you start it and you smell it afterward, you don’t really understand it.” It’s that perspective that undergirds his belief that research experience is crucial for all students, but particularly undergraduates. Undergraduate research opportunities are particularly important for students who are going to medical school or into any other health profession, as well as for those wanting to be scientists. But it is equally important for the student who simply wants to know how the world works.

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Shared facilities include the Molecular Biosciences Center and the Mass Spectrometry Center.

The 508,000 square-foot facility consolidates the scientific disciplines of biology, chemistry, environmental science, geology, physics and psychology and neuroscience, and houses 31 classrooms and lecture halls and over 200 teaching and research laboratories.

BAYLOR SCIENCES BUILDING (BSB)

Built at a cost of over $100 million & dedicated in 2004, the BSB was one of the largest building projects in the university’s 189-year history.
RESEARCH in the HUMANITIES: Approaching CULTURE CRITICALLY

For Dr. Thomas Hibbs, distinguished professor of ethics and culture and dean of Baylor’s Honors College, former chair of philosophy at Boston College and alumnus of the University of Dallas and Notre Dame, promoting a culture of discovery means, well, discovering more about culture, and then writing about it.

“Because we are the only exclusively undergraduate school or college on campus, what we’re aiming for is as high a level of undergraduate research and writing as we can possibly attain,” Hibbs explains. “We want our students to be doing serious research in the humanities, the sciences, the social sciences, but we also want them to develop habits of good writing. We foster that through intensive collaboration and mentoring by faculty who are themselves actively engaged in research and writing.”

While that may not be a particularly unique approach, successfully executing it requires intelligence, commitment and discipline on the part of faculty and students alike. And Baylor Honors College students have at times achieved success that is a bit startling.

In 2009, Baylor professor of classics Alden Smith assigned each student in his honors Latin class on Virgil’s Aeneid an abstract and submit it for presentation at the Classical Association of the Middle West and South conference in Minneapolis. Hibbs recalls what happened.

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RESEARCH in the LOUISE HERRINGTON SCHOOL OF NURSING upholds the UNIVERSITY’S RICH SPIRITUAL TRADITION by developing better ways to care for the afflicted

B仲裁 the subject of health sciences research, and the mind fills with images of scientists in lab coats amid cluttered assemblages of glassware and instrumentation, or of lab technicians welding pipettes over Petri dishes full of brightly colored gels. While that’s not at all inaccurate, it by no means represents the full picture, as Dr. Shelley Conroy would be quick to point out.

Just completing her second year as dean of Baylor’s 104-year-old Louise Herrington School of Nursing (LHSON) in Dallas, Conroy’s career has earned her an enviable array of credentials as a registered nurse, health care educator, administrator and governmental policy adviser. But she is a seasoned researcher as well, with studies about workplace stressors, rural health outreach, health care policy, health professions education and supply, and global nursing education among the $7 million in sponsored projects to her credit.

It’s not unexpected, then, that she views research as essential both to ensuring that patients get the best possible health care, and to training the professionals who deliver it.

“Nurses are the heart of health care delivery,” Conroy says. “We help our patients achieve their maximum health potential and are best equipped to see the patient as a whole, to know the patient’s environment and life circumstances.

“Research informs our practice as well as our teaching,” she continues. “It’s been estimated that the amount of new knowledge in the nursing field doubles every one to two years. We teach our students that their practice needs to be evidence-based. To do this they must be involved in research or applying knowledge generated from research.”

Conroy believes multidisciplinary research in many different medical and health fields is vital to improving patients’ health and health care.

Dr. Shelley Conroy

And while nursing research generates its own unique body of scientific knowledge, that knowledge complements and enhances other medical research.

“One example of that might be when biomedical researchers determine an ideal range of lipid or blood sugar levels,” she explains. “Nursing research may be able to develop methods of achieving those ideal levels in the way patients find most usable, practical or realistic.”

“Toward improving health care and its delivery, LHSON faculty and student researchers are at work on projects that target both the community and the globe.

“On a regional scale, Dr. Barbara Camune is working with environmental sciences researchers on a project aimed at monitoring and detecting lead toxicity in children in and around Waco. Similarly, Dr. Claudia Beal is researching ways to better educate Texas women on recognizing stroke symptoms that are distinctly different from those men typically experience.

“Globally, Lori Spies is working to improve conditions in Africa, where 80 percent of all health care is provided by nurses, and Drs. Mary Ann Faucher and Cheryl Riley are doing translational research in India, where an innovative umbilical-clamping technique may improve the life-long health of the 70-80 percent of infants there who suffer iron deficiency anemia.

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For some undergraduate students, education is a passive activity. They might learn about advanced analytical techniques in class and perform rudimentary analysis in labs, but rarely do they have the chance to do hands-on work that makes a real contribution to scholarship in their fields.

Thanks to a partnership between Baylor’s Institute for Studies of Religion and the Green Scholars Initiative (GSI), Baylor’s undergraduate students have the chance to undertake serious analysis on ancient manuscripts and text related to the Judeo-Christian story.

GSI, established by the Green family, is a multidisciplinary initiative aimed at acquiring, cataloging and preserving artifacts like cuneiform texts and papyri, Torah scrolls, Coptic biblical texts and medieval scripture and commentary manuscripts. Scholars at over 60 universities around the world conduct research through GSI. In addition to Baylor, other partners include Oxford, Cambridge and the University of London, as well as leading institutions in North America, Europe and the Mideast.

As the major research partner in GSI, Baylor is able to offer unprecedented research opportunities to its faculty and students in fields like classics, history and theology.

Dr. David Jeffrey, distinguished professor of literature and humanities in Baylor’s Honors College, says the partnership between Baylor and GSI is a natural fit that opens the door for faculty and students to include these texts and other artifacts in their undergraduate education. “Baylor has one of the world’s deepest collections of faculty expertise related to these texts,” says Jeffrey, who is also ISR’s director of manuscript research in scripture and tradition. “Because of the Green family’s resources and our high-quality faculty, our students are able to learn advanced techniques and do work that would be reserved for faculty or advanced graduate students at other institutions.”

Rachel Smith, a senior in Baylor’s University Scholars program, began working on GSI projects during her sophomore year when she assisted faculty and graduate students with analysis of early papyrus fragments from the New Testament book of Romans. By comparing the style of writing to other, known manuscripts, she was able to estimate the age of the text and draw conclusions about the size and origin of the larger manuscript from which the fragments were taken.

Currently, Smith is part of a team of faculty and students transcribing and translating the Speculum Humanae Salvationis, a 14th-century manuscript containing 45 chapters, each one a moral lesson based on a different passage from scripture. Smith, who plans to pursue a graduate degree in classics, says the experience of studying the Speculum has helped her extend her education beyond the classroom.

“It’s been a huge privilege to work on these projects with the Greens’ support. I’ve learned an incredible amount about papyrology, which will make me much more competitive when I apply to graduate schools.”

Dr. Melinda Nielsen, an assistant professor of great texts in the Honors College, agrees that Baylor’s partnership with GSI provides invaluable benefits to undergraduate students who are involved in the projects. “Many of these manuscripts have never been studied as closely as our students are studying them,” says Nielsen. “It gives our students the chance to apply their skills to something real and it lets them contribute to a tradition of study that goes back thousands of years.”

BAYLOR’S INVOLVEMENT with the GREEN SCHOLARS INITIATIVE puts some of the WORLD’S MOST ANCIENT TEXTS in the hands of UNDERGRADUATE STUDENTS.
Baylor’s culture of mentorship is predicated on the idea that frequent, meaningful contact between mentors and mentees helps junior faculty and students learn what it means to be productive and successful in their personal, as well as professional lives. In the department of mechanical engineering, two faculty members and one graduate student represent three professional generations, a microcosm of the pipeline at Baylor that helps develop bright, motivated students into the next generation of professional and academic leaders.

Drs. Doug Smith and David Jack are faculty colleagues in Baylor’s School of Engineering and Computer Science. But the relationship between Smith, an associate professor, and Jack, an assistant professor, goes back much further.

Smith and Jack met when Jack was an undergraduate student in Smith’s machine design course at the Colorado School of Mines. Smith gave his students a simple quiz on the first day of class meant to help him assess the students’ comfort with some simple engineering concepts. Rather than using simple formulas to approximate the answers to the posed questions, Jack took a different tactic, beginning with the first principles of engineering and deriving an approach to solve the problem more precisely.

The resulting discussion of Jack’s approach formed the beginning of a mentoring relationship that has seen Jack progress from Smith’s undergraduate student to graduate assistant to faculty colleague. Along the way, Jack says, Smith taught him more than just how to be a successful engineer and productive academic. Smith’s concern for his students’ personal well-being and the priority he placed on his family when making career decisions struck Jack as a model to follow throughout his own career.

Shortly after Jack finished his undergraduate degree, Smith left the Colorado School of Mines and accepted a position at the University of Missouri. While a professor’s decision to move from one university to another is not surprising in itself, Jack says the reason Smith chose Missouri resonated in his own life. “Dr. Smith had offers from a lot of schools, but he chose Missouri because it was the best environment for his family,” says Jack. “That example was very powerful for me as I was very recently married myself. It confirmed for me that he was someone I wanted to continue to have as a mentor.”

Jack followed Smith to Missouri, where he earned his Ph.D. in mechanical engineering. Jack went on to accept a faculty position at Baylor, where he says he found an ideal environment in which he could be active in teaching graduate and undergraduate students while also conducting research on nondestructive testing and analysis methods for composite materials. “I knew from working with Dr. Smith how much a student could benefit from a faculty mentor who was highly accessible. Baylor is not the only place that encourages that kind of

MENTORSHIP ENCOURAGES CLOSE, PRODUCTIVE RELATIONSHIPS that ENCOURAGE the NEXT GENERATION of ACADEMIC and PROFESSIONAL LEADERS.
“It was clear that the university, from top administration all the way to the faculty, was committed to providing the facilities and infrastructure necessary to build the program and train students well.”

A big part of what we offer our students is perspective,” Smith says. “We work with very bright students, but they may not have a broad view of how their projects fit into the field as a whole. As a mentor, I try to help students down the path of finding their niche in the discipline.”

Part of that guidance involves giving students the chance to present their work and receive feedback from a professional audience at meetings and conferences. Sarah Stair, a graduate student pursuing her master’s degree in mechanical engineering under Jack’s mentorship, says providing the opportunity to present at conferences is a key part of the mentorship she’s received at Baylor.

“Dr. Jack has been an outstanding mentor. He provides ample time for one-on-one meetings where he answers questions and provides perspective that you can’t get from talking to other students.

In mechanical engineering, and he was also excited by the university’s commitment to research.

“I really liked what I saw going on at Baylor,” he says. “It was clear that the university, from top administration all the way to the faculty, was committed to providing the facilities and infrastructure necessary to build the program and train students well.”

At Baylor, Smith continues his research agenda focused on creating computational and numeric models of the process of creating composite materials. His numerical simulations are aimed at predicting the way fibers will be arranged in a manufactured part, helping to ensure the finished product will have the necessary strength to accomplish its task.

Training and mentoring students, Smith says, is at the core of a faculty member’s job function, and he believes a critical part of that mentorship is helping students see how their work relates to the larger academic community.

In 2012, with Smith still at the University of Missouri and Jack on the faculty at Baylor, Smith visited Baylor’s campus at Jack’s invitation to give a presentation on his research to engineering faculty and students. That visit, and the discussions that followed over the next few months led Smith to make another move – this time to join his former student at Baylor. Now, nearly 15 years after that first meeting at the University of Missouri and Jack on the faculty at Baylor, Smith visited Smith’s former student at Baylor. Now, nearly 15 years after that first meeting at the University of Missouri and Jack on the faculty at Baylor, Smith visited

BA YLOR RESEARCH AND INNOVATION COLLABORATIVE (BRIC)

The BRIC is a 330,000 square-foot facility that was once a manufacturing plant for General Tire and Rubber Co. Now, the long-dormant building is once again a center of economic development and regional pride.

BOND ED TOGETHER

Composites are strong, lightweight materials that can be used in applications from consumer products to aerospace components. They can be made from synthetic or natural fibers, creating the opportunity for more environmentally sustainable manufacturing processes.

Faculty and students in Baylor’s department of mechanical engineering are studying a variety of aspects of composite materials, from modeling the orientation of fibers in finished parts to nondestructive testing methods that allow end users to evaluate the strength of a composite part without breaking it.

Baylor’s composites research is currently funded by a variety of government and industrial sponsors including the National Science Foundation and L-3 Communications.

I’ve also had the opportunity to present my work at professional meetings and network with other students and industry professionals.”

Stair conducts research focused on nondestructively analyzing products made of composite materials to compare the strength of the final, manufactured part to the original design specifications. Her research has already caught the attention of industry, leading her to receive funding for the work from L-3 Communications.

Her research posters and papers have earned honors at conferences where her work competed against not only master’s students, but also Ph.D. students and postdoctoral scholars from other universities.

At the 2013 American Society for Composites Annual Technical Conference, Stair earned top-four finalist recognition in the “Best Presentation or Paper” category, along with a second place finish in the graduate poster competition at the Society of Plastics Engineers Automotive Conference and Exhibition. She was also one of only 45 students out of 750 applicants awarded a travel grant from the National Science Foundation, which facilitated her participation in the International Mechanical Engineering Congress and Exposition.

Jack enjoys working in an environment where professors work with small groups of students and pass on their skills to the next generation of scholars. But Jack cautions that it takes special qualities in both students and teachers to achieve optimum success.

“It takes patience on both sides. Both the student and the teacher have to be willing to take a step back from the specific topic to find the foundations of a problem. That willingness to think about things more broadly is what helps you see the connections between things that don’t seem to relate to one another.”
“I see my students grow during their entire time here. That close contact gives me a special opportunity to train them in what it means to be a young professional, not just a musician.”

Music instruction can go beyond just showing students the “tools of the trade,” Powers says. He believes one of his main functions as a mentor is to help his students navigate the human elements of a career in music.

“Performing in an ensemble group gives students a great perspective on the importance of interpersonal relationships. Whether they are interested in becoming performers or music educators, we help them learn to be a professional and demand the same excellence in themselves that they expect from others.”

While faculty in the sciences might carry out experiments in a laboratory or collect samples in the field, music faculty are more likely to undertake composition, performance or recording projects.

Powers says that in the same way that a scientific experiment yields data for future investigators, musical recordings can preserve musical styles and provide reference materials for performers and students. Powers has recorded a number of albums of music by Flemish composers, helping to preserve and disseminate works from Flanders, the northern region of Belgium.

“It’s extremely important that faculty remain active in our fields,” said Powers. “Being actively involved in performing and recording at the highest levels keeps us current and vital, as well as helping us stay in touch with others in the music community.”

Those connections are important for helping Baylor graduates as they enter the job market or pursue admission at top graduate schools. Indeed, recent graduates from Powers’ studio have received scholarships and assistantships for graduate study at prestigious institutions including the Juilliard School.

Other former students are now active in professional ensembles such as the National Orchestra of Belgium and the U.S. Army Field Band. In addition, numerous music education graduates are teaching in middle and high school music programs across the country.

Although university faculty may work in a range of different fields and conduct research using a variety of different methods, one thing that doesn’t change is the importance of mentorship. By providing opportunities for students to work closely with faculty mentors, Baylor is building a pipeline that is supplying the next generation of leaders.
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BAYLOR’S PROXIMITY to many of TEXAS’ TOP MEDICAL INSTITUTIONS ideally positions the university for PRODUCTIVE RESEARCH PARTNERSHIPS.

In 1886, Baylor trustees realized that changing demographics and paths of commerce across Texas made a move from the university’s founding site in Independence an absolute necessity. Their choice of Waco was a wise one, but they could not have known just how prescient that decision would prove to be.

Today, Baylor University stands amid a network of prestigious medical research and health care institutions such as the Baylor College of Medicine in Houston, Baylor Scott & White Health in Dallas and Temple and the Baylor Research Institute in Dallas. This rich concentration of health care institutions represents a potential for collaboration that multiplies many times over the capacity for innovation of each individual institution. And it’s a potential that is being realized in life-saving ways.

Four years ago, Dr. John Chaput, orthopedic spine surgeon at Scott & White Hospital in Temple, Texas, began looking into an infrequent but serious injury to the occipital-cervical complex, or “OCC,” the region where the spine joins the skull. Usually associated with severe “whiplash” injuries, the condition occurs when ligaments that connect the very top of the spine to the skull become strained, enlarging the normally tiny gap between the two. Chaput discovered that even a small widening of the fusion-dens interval, or “BDI,” as the gap is known, can result in a fatal post-trauma injury. But the injury is often missed because CT scans can’t show ligament damage.

“It’s one of those rarer injuries, but it’s a preventable source of paralysis,” Chaput explains. “Basically at that level of injury, the patient loses the ability to breathe, so if it’s not caught it’s essentially a death sentence.”

He realized there needed to be a way to measure the BDI automatically. Ideally, the gap would be measured by the CT scanner’s computer as a part of the scanning process. Then it could display the data without any action required by the physician.

Enter Dr. Brian Garner, mechanical engineering professor at Baylor, just 40 miles up the Interstate. When Garner’s daughter broke her arm, he became friends with Dr. Robert Probe, chair of Baylor Scott & White’s orthopedic department. On learning of Garner’s biomechanical modeling work, Probe introduced him to Chaput. The surgeon described his idea to Garner and handed him the study, but it sat on Garner’s desk several months before he was able to take it on.

“It can be a little difficult to get students to contribute effectively in my research area because it generally involves a combination of familiarity with mechanical engineering and computer science,” Garner says. “We have many students familiar with one or the other, but not many familiar with both.”

Then Jacob Hoffman walked into Garner’s office. “My junior year I was looking for a research project,” recalls

OTHER BAYLOR COLLABORATIONS AND INITIATIVES

The OCC collaboration is just one instance in which Baylor researchers and graduate students are teaming with the rich vein of regional research talent. Under the direction of Dr. Bob Kane, researchers with the Baylor Institute of Biomedical Studies are working with scientists and physicians at the Baylor Research Institute, Baylor University Medical Center, and other institutions to conduct research on cancer and a host of other diseases. Baylor internists serve with the Baylor College of Medicine’s Section for Infectious Diseases in Houston, and Dr. Les Steele’s Veterans’ Health Research Program is working in partnership with Baylor Scott & White Health and the Department of Veterans Affairs on research into Gulf War illness and other conditions affecting former service men and women.

Last March, Baylor’s Office of the Vice Provost for Research and Baylor Scott & White organized a two-day Enhancing Healthcare Through Collaboration retreat aimed at fostering collaborative research between regional institutions. Held at the Baylor Sciences Building, the retreat brought together over a hundred researchers and administrators from Baylor University, the Baylor Health Care System, Baylor Scott & White Health and the Texas A&M Health Sciences Center to hear presentations on melanoma, immunology, diabetes, Gulf War illness and spine remodeling research, and to participate in topic-focused breakout sessions.

The Collaborative Faculty Research Investment Program (CFRIP) is sponsored jointly by Baylor University, Baylor Scott & White Health, Baylor Health Care System and the Baylor College of Medicine to provide seed funding for inter-institutional and interdisciplinary research project teams to position them to compete successfully for externally funded grants.
Hoffman, now a Baylor graduate student who grew up in tiny Bergheim, near San Antonio. Garner asked about projects Hoffman had been involved with, but didn’t hear anything particularly promising. As Hoffman was about to leave, Garner asked, “Oh by the way, do you know how to program?” I said, ‘Yes,’ and Dr. Garner said ‘Bingo, you’ve got the OCC project.’” Garner mentored Hoffman early on, but left him free to develop his own ideas.

“Jake is a very independent worker, and took off with the project from the very beginning,” Garner relates.

Still, Hoffman hit some obstacles early on.

“I wasn’t sure how to tell the computer to distinguish between bone and non-bone, because what might appear light or dark in one image might not in another,” he says. Hoffman devised a scheme to distinguish bone from soft tissue by mathematically comparing the individual dots or “pixels” of the electronic image with those produced by random static.

“That was a major breakthrough for me, to be able to adaptively tell what was bone and what was not.”

Chaput sums it up well.

“The project exceeded expectations on every front,” he says. “It’s that type of work in the future that is going to free up the physician from the huge amount of data that is now almost a burden to us. Instead of a surgeon, researcher or radiologist looking through hundreds and hundreds of pictures, the software can do it and call out the data or the point of interest; then the physician can assess it. Or, it can serve as an additional safety check in a stressful, fast-paced trauma situation.”

As a model of collaboration, the project could hardly have been more successful: the patent application lists researchers from both institutions as co-inventors. And the effort has had the effect of opening an already open door even wider.

“It’s a collaboration that has direct clinical application,” says Charlotte Stallworth, Baylor Scott & White Health’s associate vice president, research business development. “It provides us with a template, a business model that can be used for many other applications.”

Paul Pearce—microbiologist, entrepreneur, CEO—had a problem. And neither his Ph.D. nor 20 years in the water quality and environmental assaying business had prepared him to tackle it.

In 1993, Pearce’s newly founded Nova Biologicals became the first private laboratory approved in Texas to perform water quality compliance testing of public water systems. In 20 years, the business grew from 50 samples the first month to a monthly volume of nearly 11,000 today. That steady growth allowed Pearce to take Nova into other, more specialized and sophisticated services, such as evaluating new antibacterial and antiviral agents, and testing medical devices.

Business was good. Nova began to earn hard-to-get federal certifications from the likes of the FDA and the EPA, garnering industry respect and a potential market upward of half a million wells. But the initial design weighed 500 pounds and sold for $40,000 each. After deploying the first dozen or so units, Pearce realized the CVSD would need an extreme makeover to be successful in the marketplace. Where could he go to get help with redesign?

Chaput hit it on the head.

“Actually, I ended up being able to characterize the bones in those two months, and that was the second breakthrough for the project. The rest has just been polishing it up.”

While helping some of his clients with redesign, Pearce realized that emerging homeland security issues had prepared his company for the CVSD’s potential market to grow even further.

“Pearce’s family roots run deep in Baylor soil. Though not a Baylor grad himself, he is the lone holdout in the family. His father, Joe Jack Pearce, was an All-American, All-Southwest Conference quarterback and captain of the 1934 Bears.

His father, Joe Jack Pearce, was an All-American, All-Southwest Conference quarterback and captain of the 1934 Bears. Going back even further, Pearce’s grandfather, Joseph, and grandmother-to-be, Lizzy Carroll Jones, served as a president and vice president of the Baylor class of 1902. All his siblings and
children are “green and gold” through and through, and Pearce himself is an assistant professor of pathology at Baylor College of Medicine. So when his business partner, Baylor-alumna Stan Craig, suggested they call Baylor for help, Pearce was not the best one to working with family. Shortly, he met with Jim Kephart, Baylor’s assistant vice provost for research and director of technology commercialization and industry engagement.

“Paul came to Baylor for help redesigning his water well security system,” Kephart recalls. “His original design dated from 2012, and over the years, many of the components had been surpassed by more effective technologies.”

Kephart introduced Pearce to Drs. Brian Garner and Ian Gravagne, from Baylor’s School of Engineering and Computer Science. The pair took over from there and assembled a team of senior engineering students who pounced on the CVSD project.

“I really liked the way they handled the students,” Pearce says of Garner and Gravagne. “They told the team, ‘OK, guys, you’ve got a job to do here, go do it!’ If you run into problems come back and talk to us, but we’re not going to solve it for you.” I know the students got a lot out of it.”

In just nine months, the students completely redesigned and prototyped a new CVSD that was roughly 1/10th as large and some seven times lighter than the original device. And they needed new security and communications features to boot, while cutting the price of manufacture by more than half. Pearce was impressed. “I’m extremely pleased with the way the project came out and where we are. It’s been a very short time for product development, especially considering the fact that we’re not a production company,” Pearce says. In fact, things had gone so well that Pearce immediately began searching out ways to employ more of Baylor’s resources to his advantage.

“The process worked,” Pearce says. “It’s been one of my goals for years and years to take education out of the ivory tower and utilize it in a business sense, and to do it in a way that benefits everyone.

“If there’s anything that I’m really thankful for and proud of, it’s that I got to go up there every week and meet with the design team and talk to them, answer their questions, and work through the process with them. I wish more people could appreciate the ability to interact with academics at the university level.”

Pearce turned the project over to a Baylor “i5” team based in Macao.

“I went to Macao in early July (2013) and met with the team,” Pearce relates. “Over the next six weeks they produced a hundred-page plan for global commercialization of the unit. Now we’ve identified a short list of strategic partners and a manufacturing capability.”

Today, with patent protections in place and both domestic and international markets wide-open, the Nova CVSD is ready for prime time, giving the company a new, hardware-based revenue stream to complement its full menu of testing and assessment services.

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