

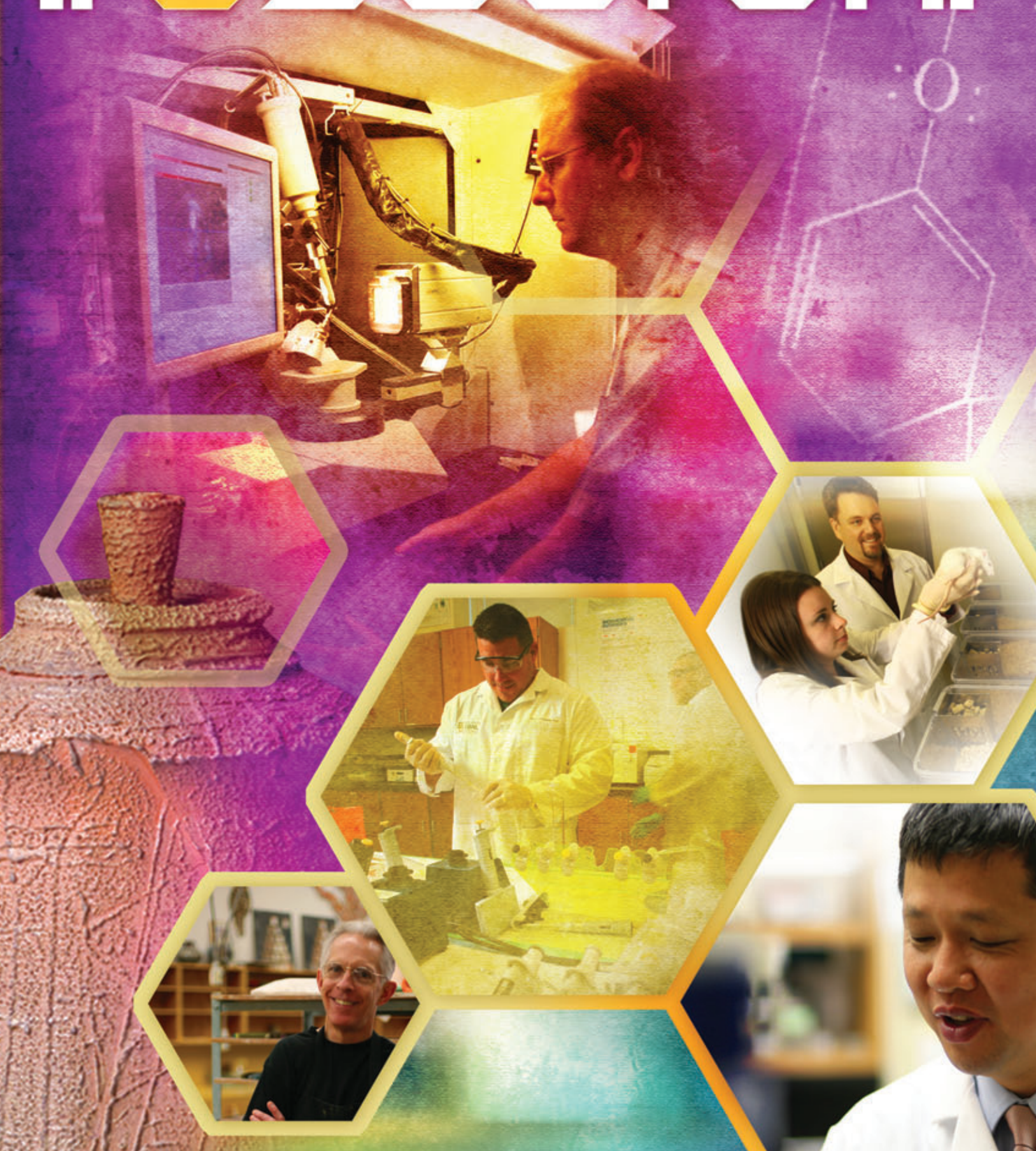
BAYLOR

research

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BAYLOR UNIVERSITY’S IMPACT IS MOST OFTEN MEASURED THROUGH INDIVIDUAL FACULTY AND THEIR INTERACTION WITH BAYLOR STUDENTS – A FAVORITE PROFESSOR’S INFLUENCE, AN ATHLETE’S OPPORTUNITY TO PLAY ON A CHAMPIONSHIP TEAM, THE BUILDING OF RELATIONSHIPS THAT LAST A LIFETIME. THE SUM OF THESE THREADS BECOMES THE FABRIC OF THE STORY OF BAYLOR ITSELF, A STORY SPILLING FROM LECTURE HALLS, LABORATORIES, PLAYING FIELDS AND PRACTICE ROOMS.

A great privilege of being the Vice Provost for Research is the opportunity to play a part in supporting these efforts. The philosophy behind such investment is simple – Baylor faculty will always be our best advertisement, and when Baylor invests in its own, external funding and acclaim follow.

Internal funding support to vital research through the purchase of new equipment, support of undergraduate and graduate opportunities, publications and more is reaping a harvest. From advancement in the Carnegie classification to dramatic increases in external proposals and funding, there is increased awareness – not just in Waco, but across the state and among our sister universities in the Big 12 – that Baylor is growing as an engine of productivity and economic impact. From international musical collaborations to science and engineering, Baylor research is making a difference. I hope you’ll enjoy reading about a few of the areas on campus where these developments are taking place.

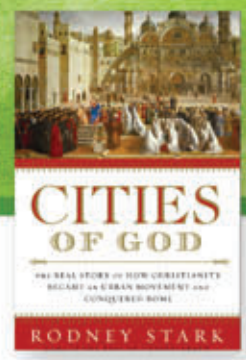
AS ALWAYS, THE 2007 ISSUE OF *RESEARCH* CAN RELATE ONLY A FEW OF OUR FACULTY SUCCESS STORIES. Please contact me to learn more or visit our website at www.baylor.edu/research. I look forward to sharing with you in the coming years the ways that research and scholarship are making a difference as we move toward Baylor’s Vision 2012. — DR. TRUELL HYDE, VICE PROVOST FOR RESEARCH



science

arts & humanities

										
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dr. truell hyde

research: The Carnegie Foundation for the Advancement of Teaching revised its widely used classification system in 2005 and Baylor progressed to “research university” status with “high” research activity. How did the change result, and what does this mean for the University?

truell hyde: In 2005, the foundation undertook a thorough reassessment of its classification system, replacing the single classification with a set of multiple, parallel classifications. As a result of this reassessment, the Carnegie Foundation developed three new categories of doctorate-granting institutions: research universities with “very high” research activity, research universities with “high” research activities and doctoral/research universities.

For some time, Baylor has awarded at least 20 doctorates per year, the threshold for consideration as a research university, but until now has never produced the additional indicators of strong research necessary for inclusion, such as research and development expenditures and science and engineering staffing levels.

The infrastructure put into place over the past five years to support faculty pursuit of external funding has resulted in a large increase in the number of proposals submitted and the subsequent funding award levels over the same time period. This increase in external funding is extremely important for the University and in large part responsible for Baylor’s recent change in Carnegie classification.

What is really exciting, in my opinion, is that this moves Baylor into a category with such universities as Auburn, Boston College, Brigham Young, Clemson, Georgetown, Temple, Texas Tech, Nevada, Oklahoma and Wake Forest. The only step above us now is substantial research institutions, such as Cal Berkeley or Harvard, both of which are included in the “very high” research category.

r: How does this fit into Baylor 2012, the University’s 10-year vision for entering the top tier of higher education?

th: All of the above are absolutely linked to Baylor 2012. Research-active faculty must have a certain level of infrastructure in place in order to successfully pursue external funding. That same faculty, once funded, support not only the production of new knowledge, but also those wonderful one-on-one interactive opportunities students remember for the rest of their lives, such as presenting at international conferences or working directly with faculty from other institutions. This in turn impacts Imperative I of the vision (establish an environment where learning can flourish), IV (attract and support a top-tier student body) and III (support an emphasis on research and publication as the path to the discovery of new knowledge while increasing participation by both graduate and undergraduate students).

I don’t find it an accident that the most recent Cornelia Marschall Smith professor, Kevin Pinney, also is one of Baylor’s most prolific researchers. In my mind, this type of scholar/teacher is Baylor 2012 and one of the reasons we’re moving forward in the rankings.

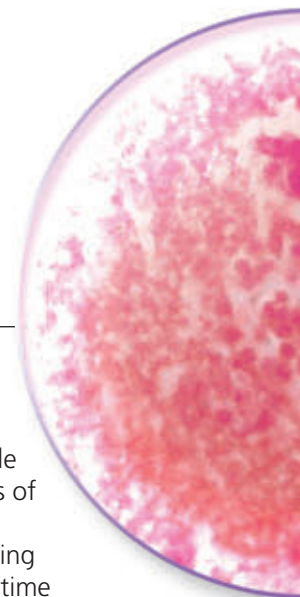
[Editor’s note: The Cornelia Marschall Smith award is presented annually to a faculty member who makes a significant contribution to the learning environment at Baylor. He or she exemplifies the highest standards in teaching, research and service.]

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cataloging

cc1ccccc1mpounds

chagas disease and cancer



ONE MIGHT SAY DR. MARY LYNN TRAWICK IS A LIBRARIAN.

Although she spends more time in the laboratory than in the stacks, the associate professor of chemistry and biochemistry is researching and cataloging a wealth of knowledge on enzymes and compounds. Some of them may lead to new breakthroughs in the treatment of pervasive disease and opportunities for valuable collaborations with industrial partners in the health care sector of the economy.

Trawick received funds from the Office of the Vice Provost for Research to test an enzyme called cruzain, a crucial element in the lifecycle of the parasite *Trypanosoma cruzi*. In humans, this parasite can cause Chagas Disease, the leading cause of heart disease in Latin America, according to Trawick. The parasite is transmitted to humans by the bite of the blood-sucking *triatoma*, commonly known as the kissing bug. It is estimated about 20 million people world-wide are infected – 500,000 in the United States – and about 50,000 world-wide die from it each year.

The University of California, San Francisco, a collaborator in the project, provided the enzyme for Trawick and her team of professors and students to work with.

Trawick began by evaluating a number of compounds against cruzain. "Our focus was to see if we could design, synthesize and evaluate compounds as inhibitors of this enzyme to block its action and thereby be useful therapeutic agents for treatment," she says. "The other important thing is that this type of enzyme is found in a lot of organisms, in almost all living things, so it gives us insight into applications in other areas."

Five Baylor-detected compounds were sent to The University of California, San Francisco for further testing. "Of those five, one of them appears to be very effective at inhibiting cells that have been directly infected with the parasite," Trawick says.

She also discovered that two of the compounds that are cruzain inhibitors restrict another enzyme called cathepsin L. Some

types of cancers are associated with high levels of cathepsin L, so any therapy that might be developed as a result of this study also could have implications for cancer research, she says.

The next step in Trawick's research is to continue testing the small library of compounds to see what other enzymes they may be

active against. She and her team have already published one professional article and are in the process of publishing two more.

Because the funding afforded her two full-time graduate students and other undergraduates in the lab, the project has more than just biomedical benefits; students are getting real-world experience. In fact, the idea for the study originated with former graduate student Rogelio Siles, who is from Bolivia and was interested in researching Chagas Disease.

Siles and several other graduate students have presented their findings at professional conferences. "[Presenting at conferences] provides a tremendous opportunity for students to meet people and make contacts," Trawick says. In addition to valuable molecular modeling and evaluation work from former and current graduate students, a number of undergraduates are involved in purifying cruzain in the lab so that the team can do more testing.

Kevin Pinney, a professor of chemistry and a partner in the project, says the research has had professional benefits. "No one person can have the expertise in all areas," he says. "If you can find ways to combine [efforts] that are useful, you have added strength and can move a research agenda along." As a researcher specializing in cancer studies, he is looking forward to furthering the work started on cathepsin L and its possible inhibitors.

Dr. Mary Lynn Trawick >
associate professor of chemistry
and biochemistry

"[Presenting at conferences] provides a tremendous opportunity for students to meet people and make contacts."

the mirror image in medicine

imagine enjoying the health benefits of a new medicine

without suffering the unpleasant side effects that often come with it.

this is one of the advantages that could result from research conducted by drs. kenneth and marianna busch with the help of funding from the office of the vice provost for research. the two professors co-direct baylor's center for analytical spectroscopy.



"Certain pharmaceutical, biological and organic compounds have a property referred to as 'chirality,'" says Kenneth Busch. "It comes from the Greek, meaning 'handedness' – it refers to molecules that are mirror images of one another, like your left and right hands."

The Busches, along with several graduate students, have been conducting chiral analysis. The data is obtained using conventional spectroscopic equipment including a fluorescence spectrophotometer that investigates how light interacts with matter. Data is then examined through the regression modeling of the spectral – or light – data.

Kenneth says the need to analyze these mirror-image compounds, known as enantiomeric pairs, arises from a trend in the pharmaceutical industry toward developing and marketing single-enantiomer drugs – the term used to describe one member of the pair.

The problem with trying to determine enantiomeric composition is that the enantiomers that make up the mirror-image pair have identical chemical and physical properties, making it very difficult to distinguish between the two. As a result, "You can't use ordinary chemical techniques," Kenneth says.

To tackle this problem, they developed a simple method using guest-host chemistry to break the mirror-image symmetry of the pair, making them distinguishable spectroscopically.

"We take a sample, mix it with a chiral-host molecule, and it forms a complex with the host molecule," Kenneth says. Because the two enantiomers interact slightly differently with the chiral host, it modifies their spectral signatures, or the way they interact with light. As a result of this technology, "we can build regression models that permit us to predict the enantiomeric composition of a sample from its spectral data."

This process is new in the field and is the subject of a pending Baylor patent application, one of many filed for various Busch projects. The results of their work on this subject may lead to additional patent applications.

The benefit of all this work is valuable to pharmaceutical companies who may want to market drugs made from the enantiomer that provides the healthy property instead of having the side-effect-inducing enantiomer that tags along.

Companies need to show that once an enantiomeric pair has been separated, the desired isomer won't suddenly revert to the undesired isomer. Once that's been achieved, Kenneth says an advantage of this procedure they envision is for it to be automated. Speed is essential for companies hoping to put new drugs on the market quickly.

Former graduate student Jemima Ingle, who received her PhD from Baylor in 2006 and is now a National Science Foundation Postdoctoral Fellow at North Carolina A&T State University, found her role in the research focusing on making the analysis method more palatable to industry researchers. Ingle came to Baylor in 2001 after hearing Kenneth speak about his work because, she says, "I could understand it."

Ingle says previous research students laid the basic foundation of the technique, so she was able to concentrate on optimizing it. "My job was to address some issues with the technique, to make it more user-friendly," says Ingle.

The original studies involved samples of equal concentration, something Ingle says is difficult to achieve in a real-world setting; instead, she performed a study using varying concentrations. "It was a fascinating project," Ingle says. The additional research possibilities that developed made it "hard to find a stopping point."

Drs. Kenneth and Marianna Busch >
co-directors of Baylor's center
for analytical spectroscopy



binding metals

07 | research 07

SCIENCE FOR THE

WHILE SOME RESEARCH BEING
CONDUCTED IN LABS ACROSS THE NATION
IS FOCUSED ON FINDING A DISTINCT
SOLUTION TO A DEFINED PROBLEM,
DR. KEVIN KLAUSMEYER'S CURRENT WORK
IS GROUNDED IN THE PUREST OF
ACADEMIC PURSUITS: LEARNING FOR THE
SAKE OF LEARNING.

SAKE OF SCIENCE

"Often it is necessary to establish a broad base of knowledge before the potential applications become apparent," Klausmeyer says. "I like to think of my work as helping to establish that broad base."

That's not to say that his focus on the synthesis of silver compounds that are linked into extended networks won't someday have a potential application. "Currently in the field there is considerable interest in polymeric and so-called 'metal-organic frameworks' containing silver ions," he says. Testing with these compounds includes making bridges between the silver ions by introducing linking groups that contain phosphorous and nitrogen compounds.

The experiments utilize a specific bipyridine compound known for its ability to bind several metals at once. The class of compounds that are subsequently created in this project, Klausmeyer says, can be studied by others for possible use in catalysis, hydrogen storage and material science. Things like nanotechnology, metallurgy, ceramics, computer chips and LCD screens all are the result of material science.

Klausmeyer notes that bipyridine chemistry with phosphines is still in development. "The field is wide open, and there are not many chemists working in it right now, although there is growing interest," he says. Klausmeyer has wanted to conduct this research for several years, and though his own background differs greatly from the nature of the research, "I was able to learn a lot as we started this project. My background is in organometallic chemistry, and the work that I do now is more in the area of coordination chemistry," he says. These distinct but related sub-fields are classified under inorganic chemistry.

"I have always approached science as a pure science," Klausmeyer says. "I like to find things out for the sake of discovering them."

"OFTEN IT IS
NECESSARY
TO ESTABLISH
A BROAD BASE OF
KNOWLEDGE
BEFORE THE
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BECOME APPARENT."

< Dr. Kevin Klausmeyer | chemistry professor

With the help of funding from the Office of the Vice Provost for Research, Klausmeyer purchased lab equipment and supplies for carrying out the research; he primarily employs fluorescence and X-ray crystallography in the work he does with silver compounds. In his X-ray crystallography work, Klausmeyer says he has determined the structure of more than 100 new compounds. As proof the initial Baylor funding for his project paid off, Klausmeyer received an additional \$150,000 from the Robert A. Welch Foundation over three years.

Klausmeyer's team has published its findings in eight peer-reviewed journals, with more being prepared for submission. He says the knowledge gained from this research will be applied to other metals, including gold, in the near future. And, with each new discovery comes the need for more research. "This project will go on for many years because with every new discovery we have even more questions," he says. "If we run out of questions, I will move on to something else."

"THE REAL-WORLD SIGNIFICANCE
WOULD COME FROM IDENTIFYING
NEW AVENUES FOR TREATMENT
OF MENTAL
DISORDERS."

correlating epilepsy & emotional disorders

Thanks to the Faculty Research Investment Program (FRIP), senior honors student Cathryn Hughes was able to spend most of her summer crafting an article published last fall in a national epilepsy journal.

Her mentor and co-author of the article is Dr. N. Bradley Keele, whose research in the potential correlation between epilepsy and emotional disorders was awarded internal funding from the Office of the Vice Provost for Research.

"It has been really exciting to help put science into action, applying what we know about the brain, asking new questions and getting interesting results," says Hughes, who will graduate with a neuroscience major and biochemistry minor in May and hopes to enter an MD/PhD program. "I feel very blessed to have had such an outstanding research experience during my undergraduate years."

Keele, an associate professor of neuroscience, psychology and biomedical studies at Baylor since 1998, has been studying the amygdala – the almond-shaped part of the brain that controls many emotional behaviors, especially aggression, fear and anxiety – since the early 1990s.

Now, he has focused his efforts in examining neuronal excitability in the amygdala through a learning paradigm called fear conditioning.

"We're using this fear-conditioning model to look at how different chemicals, neurotransmitters and drugs affect amygdala function ... to tell us something about what's wrong in the brains of people who have emotional disturbances," says Keele, who earned his PhD from the University of Texas Medical Branch at Galveston.

In his lab, rats develop a central fear state through the pairing of a bright light and a very mild foot shock, which Keele likens to the "zip" of static electricity.

Additionally, serotonin, a neurotransmitter necessary for normal emotional experience, is suppressed, resulting in a heightened startle reflex. When the electrical activity of amygdala neurons is studied, a burst of impulses is observed, he says, "that is very much an epilepsy-like phenomenon."

"If we know that the amygdala is involved in both emotion and epilepsy, it makes sense – to me, anyway – to start

looking at some of the overlap between these two," says Keele, who notes that people with epilepsy often have emotional disorders.

One successful treatment for the rats has been an anti-convulsive medication typically prescribed for epileptic seizures, he says.

"The real-world significance would come from identifying new avenues for treatment of mental disorders. Right now, we still need some help. This will give us some of the core biological basis for designing newer, more effective and, perhaps, valid drug therapies for mental illness," he says.

About 15 percent of the U.S. population will experience a major depressive episode. A first episode increases an individual's chances of another episode to 80 percent, Keele says.

At present, he says his primary goal is to attract some significant federal funding for additional research, something the FRIP is making possible. "I hope that by completing the studies outlined in the proposal we will convince others how exciting and interesting it is," he says. The research "will give us a foothold, a step in the right direction."

< Dr. N. Bradley Keele
associate professor of
neuroscience, psychology
and biomedical studies

STUDYING SEIZURES AND ALCOHOL ABUSE

FOR DR. JAIME (JIMMY) L. DIAZ-GRANADOS, THE SECOND TIME WAS THE CHARM IN SECURING NATIONAL FUNDING FOR A NEW IDEA IN HIS LAB'S RESEARCH ON ALCOHOL WITHDRAWAL-RELATED SEIZURES.

Critical to the successful resubmission was the internal grant the Office of the Vice Provost for Research awarded him in 2005 through the Faculty Research Investment Program (FRIP), which provided the necessary time and resources for a winning proposal, he says.

"This is a wonderful mechanism to help faculty," says Diaz-Granados, chair of the psychology and neuroscience department and associate professor of psychology, neuroscience and biomedical studies. "One of the conditions of being successful with the FRIP is going out and making an attempt to get [external] money. In our case, we were not only able to attempt, but we were also able to bring in the dollars."

In September 2005, the National Institute on Alcohol Abuse and Alcoholism (NIAAA) awarded him \$225,000 over a two-year period for his research on taurine – an amino acid – and its effect on alcohol withdrawal-related seizures.

Using a murine (mouse) model, subjects chronically exposed to alcohol become dependent and suffer from withdrawal when the substance is no longer available, Diaz-Granados says. When the mouse is administered taurine – either prior to alcohol exposure or during withdrawal – the severity of the withdrawal symptoms is lessened significantly, he says.

"TAURINE SEEMS TO HAVE SOME NEUROINHIBITORY EFFECTS, WHICH MAY BE ONE OF THE REASONS WHY IT MAY ALLEVIATE SEIZURES," HE SAYS.

Diaz-Granados, who earned his PhD in behavioral neuroscience from the University of Texas at Austin, has long been researching the lasting effects of alcohol exposure to adolescents.

"Looking at taurine was a bit of a departure from our normal research program," says Diaz-Granados, who credited the discovery of taurine's potential in 2002 to then-graduate student André Zalud, now a PhD candidate in biomedical

studies. Zalud brought his hypothesis to Diaz-Granados and the two men began research on a small scale, leading to the FRIP award. Zalud has developed the methodology "and brought a whole new area of research to the laboratory," Diaz-Granados says.

Zalud, (BS '99, MS '02), says being in the "research trenches" is challenging, yet fulfilling.

"Research discovery lies at the heart of scientific investigations, and for most, drives a researcher to work countless hours for the possibility of advancing our knowledge and benefiting human health," says Zalud, who expects to complete the PhD program in 2007. "I feel most fortunate in this regard, especially since taurine could provide a very simple solution to otherwise complicated health problems."

Currently, neurochemical measures are taken from the mice only two times – during "hour zero," when the animal first comes off the alcohol and "hour 24," when all the alcohol is out of the system and the animal has experienced the withdrawal syndrome, Diaz-Granados says. "It would be nice to know what's going on during withdrawal. Further exploring the time course is one place we need to go next."

He expects to apply for additional funding from the NIAAA. "This work was funded by a Developmental and Exploratory NIAAA grant and is just the first best guess," he says.

"The benefit of investigating the ameliorative effects of taurine on the consequences of chronic alcohol exposure is twofold," he says. "One, it will reveal new knowledge regarding the actions of alcohol, and two, it could lead to a new mechanism by which to treat the negative effects of alcohol abuse."

^ Dr. Jaime L. Diaz-Granados
chair of the psychology and neuroscience
department and associate professor of psychology,
neuroscience and biomedical studies

ON THE EAST SIDE OF BAYLOR'S CAMPUS IN THE TOWERING BAYLOR SCIENCES BUILDING STANDS IN CONTRAST SOME OF THE SMALLEST CELL RESEARCH TAKING PLACE IN THE UNIVERSITY'S LABS. Dr. Myeongwoo Lee and his team of graduate and undergraduate students are spending their time studying fertility – specifically how ovulation occurs by researching how the ovaries know when to release a mature egg.

"It could eventually lead to increased fertility."

Dr. Myeongwoo Lee | assistant professor of biology >

researching
reproduction

a chemical communication

"We believe it's controlled independently through a chemical communication between the egg and ovary," says Lee, an assistant professor of biology at Baylor since 2002. "We are studying a family of cell surface proteins, called integrin, which are responsible for communication between the cells and their environment."

To understand how integrin controls the function of the ovary, Lee is studying a specific type of worm, *Caenorhabditis elegans*. These microscopic worms contain many of the same cell types, proteins and tissues as mammals, but carry far fewer genes than mammals, making them easier to study. Lee and his team are looking at 300 genes and their individual roles.

"The final goal is to isolate the genes responsible for releasing the egg," Lee says. "If we can do that, it could eventually lead to increased fertility."

Research into this type of recombinant DNA, which combines DNA molecules, is an area of biology that has grown exponentially at Baylor over the last several years.

Baylor provided the start-up costs for Lee's research, which later allowed him to compete successfully for a federal grant from the National Institutes of Health (NIH) to increase the size and scope of the research. The grant's funds, however, were not immediately available and left him with a nearly year-long funding gap. The Office of the Vice Provost for Research provided additional funds as part of the Faculty Research Investment Program. Lee was able to buy critical research equipment and supplies, which showed the NIH and other possible funding partners that Baylor was committed, making the research program stronger and more competitive for future funding.

Lee says students are the ones benefiting the most from the new research area. While three graduate students are involved in the research, his team also consists of seven undergraduates. Additionally, in the last three years, 10 students, including six undergraduates, were co-authors on three research papers Lee submitted for publication.

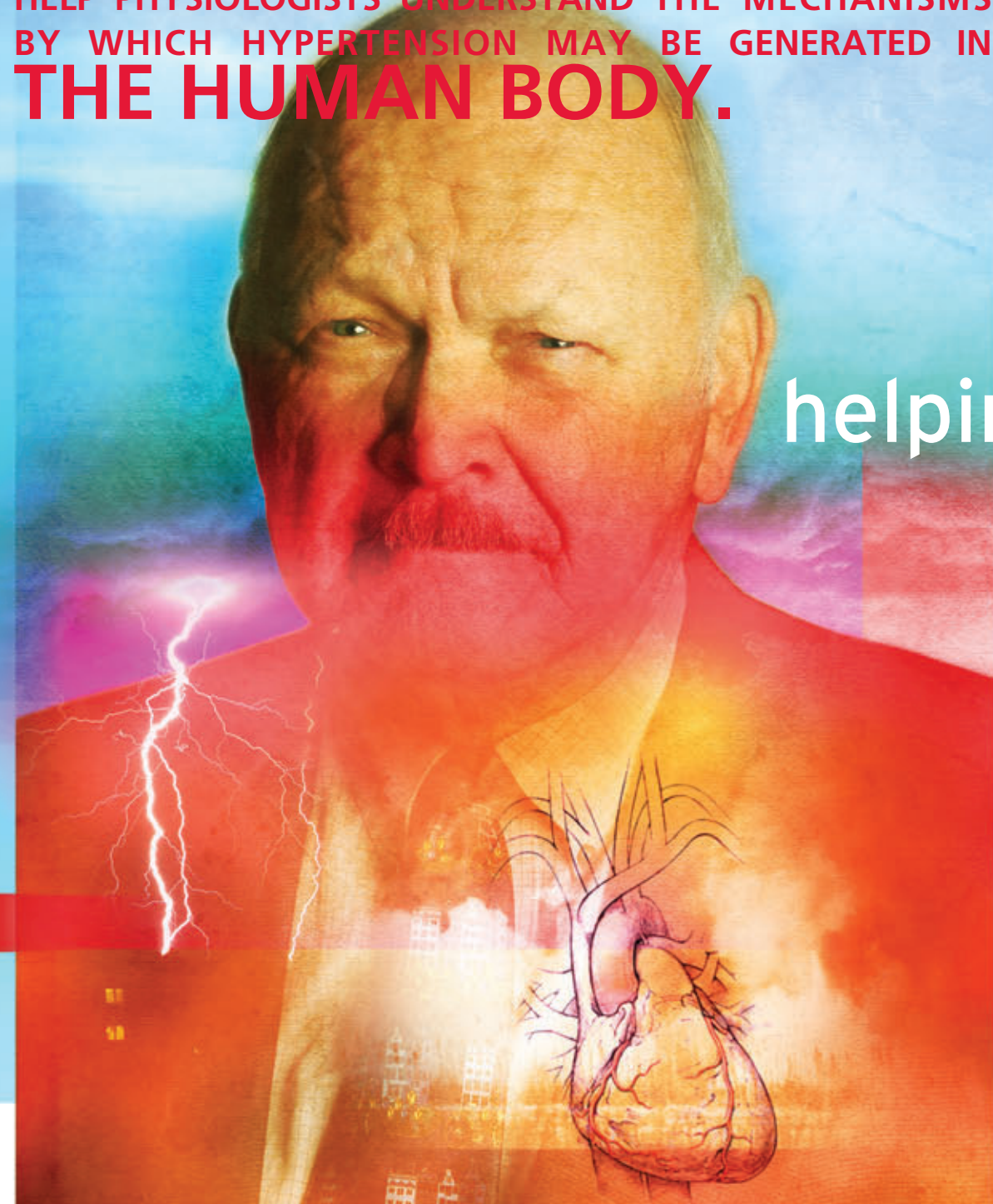
Hung-Ying Shih, a graduate student from Taiwan, says he feels lucky to have the rare opportunity of having his name published as a Baylor undergraduate.

"To me, the biggest benefit is what you learn from the research and the work you do to get published," says Shih, who is now working on a second paper as a graduate student.

Lee says many times students with published papers "get the edge" when potential employers review their résumés.

"This research is trying to answer some of the most basic biological questions," Lee says. "I've been able to involve and attract more and more students to this program because it's very robust, unique and at the same time, simple."

PICKING UP WHERE HE LEFT OFF MORE THAN 25 YEARS AGO AT JOHNS HOPKINS SCHOOL OF MEDICINE, DR. WILLIAM D. HILLIS AND SEVERAL BAYLOR STUDENTS ARE ENGAGING IN RESEARCH THAT WILL HELP PHYSIOLOGISTS UNDERSTAND THE MECHANISMS BY WHICH HYPERTENSION MAY BE GENERATED IN THE HUMAN BODY.



helping

the silent killer hypertension

"All this work has been made possible by the availability of FRIP [Faculty Research Investment Program] funding," which was awarded in May 2005, Hillis says. "I was fortunate to have had the assistance of 12 undergraduate students in this work, all of whom were the principal investigators." The FRIP grant also provided Hillis with the equipment needed to carry out his research.

Hillis, The Cornelia Marshall Smith Distinguished Professor of Biology, works primarily with pre-medical candidates. Together they have been growing rat adrenal (zona glomerulosa) cells in vitro to determine the effects that known stimulators and inhibitors have on the cells' aldosterone production. Aldosterone is a steroid hormone that regulates sodium, potassium and fluid balance in the blood.

"WE'VE FOUND THAT POTASSIUM DIRECTLY STIMULATES THE PRODUCTION OF ALDOSTERONE – SOMETHING THAT HAS LONG BEEN EXPECTED ON THE BASIS OF CLINICAL EXPERIENCE," SAYS HILLIS. TO HIS KNOWLEDGE, HE ADDS, IT HAD NOT PREVIOUSLY BEEN DEMONSTRATED TO BE DIRECTLY RESPONSIBLE FOR ENHANCING ALDOSTERONE PRODUCTION.

For one undergraduate, the research project was a testament to Hillis' desire to let students learn from their mistakes. Senior biology major Eileen Follett signed up for the team after meeting

with Hillis, though she'd never taken his class. "I was in the midst of writing my honors thesis, and I had to do research for it," Follett recalls. "There is almost no research like this being done."

The lab work, which involved extracting collagen from rat tails, mixing it with acetic acid to solubilize it, reconstituting it by neutralization, and finally allowing adrenal cells to grow on it, was Follett's first foray into self-guided testing. The students then divided into teams to test the effects of different hormones and chemicals on aldosterone production by the adrenal cells.

As a relative newcomer to the research experience, Follett says, "I can't tell you how many times I started over." But, she adds, she appreciates Hillis' willingness to let the students take the lead on such a groundbreaking project. As a result of last year's work, Follett's thesis now centers on the project: She is examining how, and why, a certain hormone affects aldosterone production.

In his research, Hillis found that the hormone angiotensin II also contributes to an increase in aldosterone production. Angiotensin II is basically produced by the enzyme renin, which is released from kidney cells when they experience low oxygen availability. Hillis says his findings will indirectly affect clinical practice in the care of hypertension and will allow him to begin the next step of research, which is to determine whether other hormones, neurotransmitters or neuromodulators will have an affect on aldosterone production.

According to Hillis, the renin-angiotensin-aldosterone axis is a system that apparently contributes frequently to the genesis of essential hypertension, a disease that presents itself in 50 to 60 percent of older Americans. "I would love to find a biologically active substance that would inhibit aldosterone production," he says, "in which case it might be useful as a possible therapeutic mode – to test clinically whether it might ameliorate hypertension."

< Dr. William D. Hillis | the cornelia marshall smith distinguished professor of biology

AS SOMEONE WHO'S SPENT A LOT OF TIME IN THE GYM SINCE HIS HIGH SCHOOL DAYS, DR. DARRYN WILLOUGHBY IS INTERESTED IN THE SCIENCE BEHIND EXERCISE. Funding for two of his most recent studies came from the Faculty Research Investment Program and allowed him to focus on the effects of stress, antioxidants and different types of exercise on muscles.

muscle man

Willoughby's first study focused on the effects of two antioxidants. In situations of high stress or heavy exercise, the human body produces oxygen-free radicals. This process is called oxidative stress. The formation of these radicals can cause DNA degradation and, in extreme cases such as radiation stress, prompt cancer, he says.

Health experts recommend consuming vegetables or supplements high in antioxidants to ward off the effects of free radicals in the body. "You eat these foods thinking you can actually provide your body with a defense against the formation and subsequent attack of these radicals," Willoughby says.

Willoughby gave two antioxidant supplements to people doing an extreme exercise program to see how effective they were in reducing the amount of free radicals produced.

"Both supplements had some positive benefit at being able to reduce oxidative stress," he says. The results indicated antioxidants could be used to help exercisers recover from workouts faster. Because heavy exercise can reduce the immune

system's effectiveness, antioxidants also might be used to maintain health, he says.

Over the course of his research, outside agencies have become interested in Willoughby's research. A company specializing in nutritional supplements awarded him \$130,000 for a trial, and he is presently negotiating with three other companies for awards of \$100,000, \$60,000 and \$50,000.

"By way of scientific publications, presentations and contributions to our field regarding the effectiveness of nutraceuticals, it is exciting to see that the research we've been doing is causing others to take note. We're hoping to continue to form more partnerships like this in the future," Willoughby says.

His second Baylor-funded study focused on the molecular mechanisms in muscle affected by different intensities of exercise – whether a person is doing more repetitions with lighter weights or less repetitions with heavier weights.

When a person does resistance exercise, muscles become larger and stronger. Willoughby says what contributes to this result is called signal transduction pathways, or pathways involved in turning on certain genes within muscles. Over time, these genes that are alerted help synthesize new proteins.

"The new protein in muscle is what ends up building the muscle size and strength improvements we see and feel," Willoughby says. "We wanted to see if different exercise intensities affect these pathways and the different gene expressions." He discovered that both types of resistance increase pathway activity.

WILLOUGHBY SAYS THIS RESULT IS VALUABLE INFORMATION PARTICULARLY FOR ATHLETES TRAINING IN THE OFF SEASON AND THOSE WORKING TO RECOVER MUSCLE STRENGTH THROUGH LOW-IMPACT WORKOUTS.

"There's an idea that in order to help muscle improve, you have to go to heavy [weights]," he says. "It's not necessary to lift heavy to encourage these pathways."

In addition to the potential medical implications of this type of research, Willoughby says the funding he received from the Office of the Vice Provost for Research gave his students opportunities to learn how to use the biotech equipment necessary for the projects.

Lemuel Taylor, assistant professor of exercise physiology at the University of West Florida, was one of Willoughby's doctoral students working on the second project. "The [Baylor] grants that Dr. Willoughby received were critical to fund my dissertation research," he says. "Without this support, my project would have been limited."

"While this grant helped me develop very important, critical pilot data I can use to find additional funding, I had other students involved that I trained and taught and mentored to prepare them for what they're doing now," Willoughby says.

Dr. Darryn Willoughby >
associate professor
of exercise biochemistry
and molecular physiology



Q&A

continued

dr. truell hyde



r: Let's widen the picture a bit. What does the reclassification mean for the city, coupled with the research results from Market Street Services, which is the national economic development consulting company hired by the Greater Waco Chamber of Commerce to assist in crafting a strategic economic development plan?

th: I know for a fact that Baylor's recent Carnegie reclassification is of great interest to many in Waco city government. Market Street's primary charge was to design and implement a comprehensive strategic plan for sustainable economic growth in the Greater Waco area. Their final report to the Chamber emphasized the importance to the region's economy that a research university can have. As a result, city leadership from the mayor on down understands that the classification of Baylor as a research university holds great promise for the Waco community and for economic growth.

Such success impacts the entire region, since integration of teaching and research not only produces excellence in the classroom, but drives entrepreneurship and job creation,

which are the cornerstones of any vibrant economic development. Equally important is that Baylor 2012, with its emphasis on our mission, also provides programs enhancing the arts and humanities. Examples include the Waco Symphony, the Baylor Theatre or enhancing the quality of education within the Waco Independent School District through the recently awarded \$11.4 million GEAR UP Waco grant. All of these directly influence the overall quality of life, in turn impacting economic development since businesses are more eager to locate in a community that provides a quality education and supports the arts.

The Market Street report to the city also emphasized the importance of the establishment of the Baylor Advanced Research Institute (BARI). One of the reasons the city is so excited about the BARI coming online is that it provides yet another avenue for Baylor to partner with Baylor alumni-owned businesses, TSTC Waco, industrial and educational partners, and state and federal government. The beginnings of such partnerships have been put in place over the past five years; the BARI provides a tangible network through which partnerships can occur in a more rapid and dynamic fashion.

The cumulative effect of these activities, in addition to providing exciting opportunities for Baylor faculty, students and alumni, is to contribute to implementation of the Market Street plan in a number of important areas, such as those delineated in Goals 1, 2, 3 and 5 of the final report. (See <http://www.wacochamber.com/strategicplan.php> for more details.)

r: Let's look at still the larger picture and what the Carnegie reclassification means with the governor's cluster model designed to make an economic impact in certain fields at the state level. The last *Research* issue focused on the model. This issue shows that Baylor continues to produce research in these fields, particularly in the areas of biotechnology and the life sciences.

th: Gov. Rick Perry recently said that the cluster initiative is important because, for the first time in history, we will be able to develop a coordinated, market-driven economic development plan for the state of Texas. As mentioned in *Research* '06, Baylor already is pursuing research in the governor's targeted areas, and the new Baylor Advanced Research Institute will optimize our chances for state investment.

arts & humanities

pages 21-26 >>>



◀ Stephen Heyde
the mary franks thompson
professor of orchestral studies
and conductor-in-residence

STEPHEN HEYDE'S RESEARCH TAKES PLACE IN A DIFFERENT KIND OF LAB – AN INTERNATIONAL ONE.

Internal grant money from the Office of the Vice Provost for Research funded his October 2004 trip to Belgium, where he attended a convention at the International Society of Music Education; and Budapest, where he acted as guest conductor at the prestigious Liszt Academy, alma mater of many famous composers and conductors. This fall, two years later, Heyde, The Mary Franks Thompson Professor of Orchestral Studies at Baylor, welcomed to campus quite the souvenir from his trip.

taking note

Seventeen distinguished musicians from the Flemish, or northern, section of Belgium visited Baylor for two weeks in September 2006 to present a series of 12 concerts. The large-scale event, which included the participation of every area of the School of Music, was called Flemish Fortnight.

"The Flemish government has paid to send these musicians to Baylor, and Baylor has paid for their accommodations and the printing of the programs," Heyde says.

"It's a tremendous opportunity for students and faculty. When students hear something like that they understand what's possible," he says. "When we talk about Belgium being the cradle of western music, they know what that means." Heyde hopes that the connections students and faculty have made as a result of the event will open doors for further study for others in Europe.

Not only were the performances a learning experience, but interacting with people from another country was a valuable lesson, he says. "The ability to understand that people of all cultures have the same dreams and aspirations is one of the most important things in the tense times we live in."

His experience in Europe also helped him further hone his skills by interacting with other musicians and educators, he says. And this benefit extends to the Waco community as well. In addition to teaching at Baylor, Heyde serves as conductor and music director of the Waco Symphony Orchestra.

"The things that Baylor allowed me to do in going to Europe made me a better musician, made me more aware and a better conductor," he says.

"I am delighted that Baylor University views research in its broadest sense, that is, to increase the body of knowledge in whatever way possible," says William May, dean of the School of Music. "The interaction of working musicians in Europe with counterparts in Waco offers a wonderful opportunity for knowledge building."

Heyde says music has other benefits as well. "While listening to music can help your blood pressure and relieve stress, it is far more significant for helping people connect in a communal experience in an ever increasing isolating and emotionally sterile world."


Bringing quality musical performances like the Flemish Fortnight and other artistic events to Waco also helps build the economy, Heyde notes. "When you are trying to attract industry, the kinds of people you are trying to attract are the kind of people who ask, 'What does the community have to offer?'" Heyde says. Offering arts opportunities makes Waco more attractive to prospective employers and citizens. "Baylor investing in me not only helps the orchestra program at Baylor, but it has been able to impact the community in which Baylor is located."



A Conductor's Contribution





FACULTY IN THE BAYLOR WOODWIND QUINTET IN THE SCHOOL OF MUSIC HAVE BEEN SPENDING TIME IN PLANO AT THE ST. ANDREW UNITED METHODIST CHURCH, NOT TO ATTEND SERVICES OR CONTEMPLATE LIFE, BUT TO TAKE ADVANTAGE OF THE ACOUSTICAL VALUE AND RECORD SEVERAL WORKS IN THE SANCTUARY. THE FIVE WILL BE RELEASING A NEW CD THIS YEAR, THANKS TO THE HELP OF FUNDING FROM THE OFFICE OF THE VICE PROVOST FOR RESEARCH. 

“It’s not for personal profit or recognition,” Helen Ann Shanley says of the project, which showcases the creative skills of composers who developed ties to the University and subsequently created pieces for woodwind and mixed performance. The quintet was founded more than 30 years ago.

“Since 1971 or ’72, we’ve had a lot of works either written for us or that we have premiered,” Helen Ann says. “We wanted to showcase music that has Baylor connections.”

Shanley and the other members of the quintet – Dr. Doris DeLoach, oboe; Dr. Richard Shanley, clarinet; Dr. Matthew Morris, bassoon; and Mr. Jeffrey Powers, French horn – are in the final stages of producing the CD. Mr. Todd Meehan served as accompanist on percussion.

“It was time-consuming,” Helen Ann says. “For five different people, it’s very intense to bring the music together ... for each person to be satisfied with the final product.”

Even after exhausting six-hour recording sessions and hundreds of hours more spent sorting through the most appealing tracks, the quintet is pleased with the results. For bassoonist Morris, the intense personal collaboration with his colleagues reflects the beauty of chamber music. “It’s a give and take, and that is the reason chamber music is so rewarding and challenging, and why we are one of the few schools with an organized chamber music program.”

For their long hours of preparation, rehearsal and editing, the faculty received partial release time from teaching and support for sabbatical time. In addition to production of the album, for which the group is in the process of securing additional funding, the quintet will write the liner notes – the information that appears on the insert that comes with the CD – to accompany the music.

Featured on the album are five of at least 21 pieces either commissioned by or dedicated from other composers who have been involved in the ongoing success of the quintet.

“It became apparent that it was important for the legacy of the Baylor Woodwind Quintet to make this music available for others to enjoy,” Helen Ann says. “These are all very good pieces and deserve to be heard by other performers and composers.”

The featured composers and their respective works are: Paul Richards from the University of Florida, who was at Baylor from 1998 to 1999 and dedicated the piece *Woodwind Quintet, (Ars Antiqua)* (1999); Charles Rochester Young, chair of composition and music theory at the University of Wisconsin-Stevens Point (BME ’87), who was commissioned to write *Three Summer Evenings* (2000); Scott McAllister, Composer-in-Residence for the Baylor School of Music, who created *With Growing Wind and Tide* (2002); and the late Richard Willis, Composer-in-Residence at Baylor from 1964 to 1997, who created *Colloquy for Quintet and Percussion* (1972) and *Six Miniatures for Woodwind Quintet* (1983).

Helen Ann says this volume of music is hopefully the first of many CDs featuring the ensemble. “We have a list of pieces we deem important for sharing,” she says. The new CD will be available to a national audience.

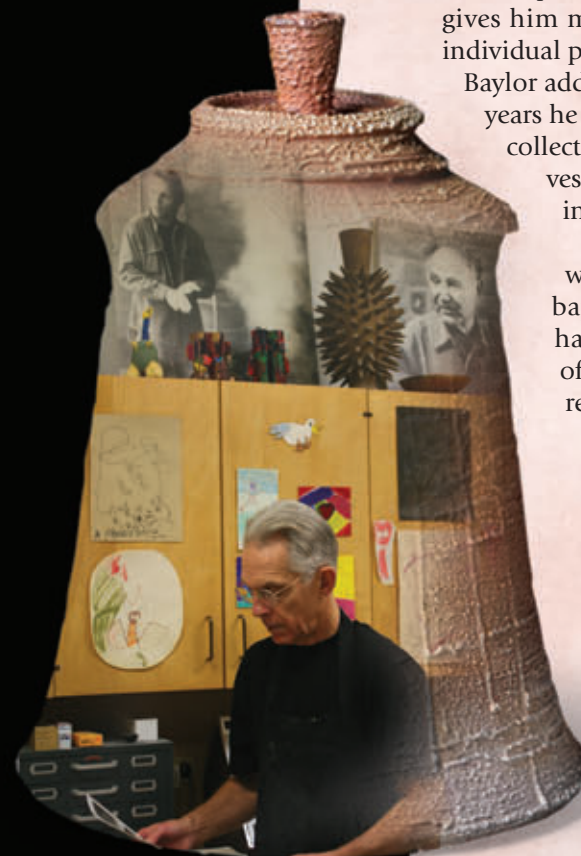
[Baylor’s Woodwind Quintet >](#)



CERAMIST-IN-RESIDENCE UNITES ART AND CULTURE

THERE ARE TWO BLOWN-UP SNAPSHOTS ON THE WALL ABOVE THE CUPBOARD. | ONE IS OF A YOUNGER PAUL MCCOY, BAYLOR'S CERAMIST-IN-RESIDENCE AND PROFESSOR OF ART, TAKEN FOR AN EXHIBITION. THE OTHER IS OF FORMER SAN ANTONIO CERAMIST HARDING BLACK, WHOSE WORK WAS CRITICAL TO 20TH-CENTURY CERAMICS. | McCoy is the curator of Baylor's Harding Black Ceramic Archive, which includes a large collection of Black's pottery and his entire body of glaze research, considered by many to be the largest body of personal glaze research executed in the United States during the 20th century.

^Paul McCoy
ceramist-in-residence and
professor of art



The dress code is casual.

Jeans and a T-shirt are a practicality when working with ceramics. This is exactly how you will find Paul McCoy. Casual would not be the word, however, to describe his intricate and historically based works.

His position as Ceramist-in-Residence gives him more freedom to pursue individual projects for exhibitions and gives Baylor added recognition. The past few years he has been developing a personal collection that follows the theme of vessels used throughout history in ritual-based activities.

"This current body of artwork, which includes forms such as baptismal fonts, funerary urns, harvest vessels, sacrificial and offering vessels, has developed in response to my lifelong obsession

with the relationship of life and death, the juxtaposition of the physical moment with the eternal," McCoy says. "It is informed by over three decades of study of the manner in which various cultures, both indigenous and industrial, interpret and reconcile this relationship."

Through investigating "primitive" cultures, McCoy says he has discovered parallels between the belief structures and systems of ancient and present Western civilizations. These parallels are highlighted in his present collection. "These are essentially vessels, but they are constructed and resolved in a way that is very sculptural," McCoy says. "They've been very well received at the professional level. I am excited because it is a body of work that keeps developing."

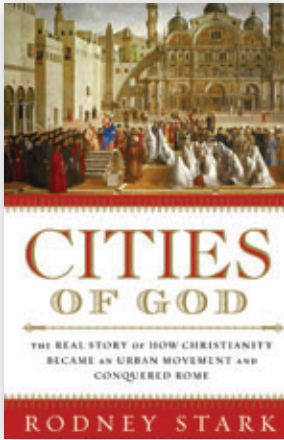
beyond the clay door

McCoy has pieces on display in museums and universities in diverse locations around the United States, England, Argentina, Tasmania, the Netherlands, China, Korea, Thailand, Japan, the Czech Republic and Bermuda. Pieces from the collection of ritual vessels are included in some of the more recent exhibits. Other exhibits are of functional and sculptural ceramics, from serving platters to pure sculpture.

"I believe that what truly separates my work from that of other ceramists is the manner in which I touch and resolve my forms. Forty-two years of working with clay has resulted in a visual vocabulary which is unique to me, as one's signature is unique to the individual," McCoy says.

As part of the preparation process, McCoy conducts research on the customs, creation myths and ritual-based artwork from worldwide indigenous cultures. "In each piece I attempt to integrate human activity and the forces of nature," McCoy says. "Art does not exist as a separate and isolated entity within culture. It is, by definition, a defining manifestation of the culture from which it originates." Most of his work is conducted on the potter's wheel, although alterations to symmetry and surfaces are made with various tools.

McCoy has taught at Baylor for 20 years and before that for a number of years in high schools. "At its best, I am able to come away from my professional work with a sense of awe, amazement, humility and excitement with regard to the possibilities it suggests," McCoy says. These emotions are what he strives to bring to each class period. "My general perspective is that all humans by definition are creative individuals. My job as a teacher is to nurture that creativity. In order to do that for a lot of students, you have to expose them to their creativity, you've got to help them see that it actually exists within them," McCoy says.



Cities of God:
The Real Story of How Christianity Became an Urban Movement and Conquered Rome
By Rodney Stark

How did the preaching of a peasant carpenter from Galilee spark a movement that would grow to include over two billion followers? Who listened to this “good news,” and who ignored it? Where did Christianity spread and how? Based on quantitative data and the latest scholarship, preeminent scholar and journalist Rodney Stark presents new and startling information about the rise of the early church, overturning many prevailing views of how Christianity grew through time to become the largest religion in the world. Drawing on both archaeological and historical evidence, Stark is able to provide statistical evidence on the religious life of the Roman Empire to discover facts that set conventional history on its head. By analyzing concrete data, Stark challenges conventional wisdom about early Christianity, offering a clear picture of how this religion grew from humble beginnings into the faith of more than one-third of the world’s population.

Publisher: HarperSanFrancisco | Page count: 288 | Year published: 2006

Illuminating
Luke:
The Public
Ministry of
Christ in Italian
Renaissance
and Baroque
Painting
By Heidi J. Hornik
and Mikeal C.
Parsons



This is the second volume of a trilogy titled *Illuminating Luke*. The highly successful first volume, *The Infancy Narrative in Italian Renaissance Painting*, established the methodology to be used by Hornik, an art historian, and Parsons, a biblical scholar. Narratives unique to the Gospel of Luke (or with unique details) and paintings illustrating these subjects in the Renaissance (1300-1590) are the focus of the chapters.

In the second volume, *The Public Ministry of Christ in Italian Renaissance and Baroque Painting*, the methodology remains the same, but the art historical area is expanded to include the Baroque period in Italy (17th century). Each of the five chapters begins with an overview of the biblical text and a brief history of the interpretation of the narrative (Baptism of Christ, Miraculous Draught of Fishes, Good Samaritan, Rich Man and Lazarus, Christ in the House of Mary and Martha and the Prodigal Son). A discussion of the life of the artist (Tosini, Raphael, Bassano, Allori and Guercino) and an art historical analysis of the form and content of each painting follows. The religious iconography of the painting is meticulously studied in reference to the biblical text and other non-biblical sources influential to the painter. The chapter concludes with hermeneutical reflections for the contemporary community.

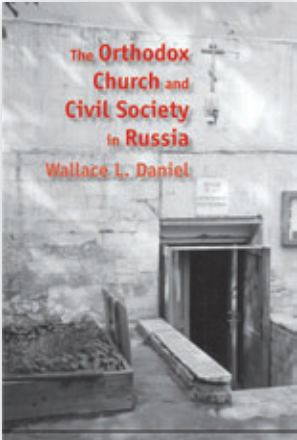
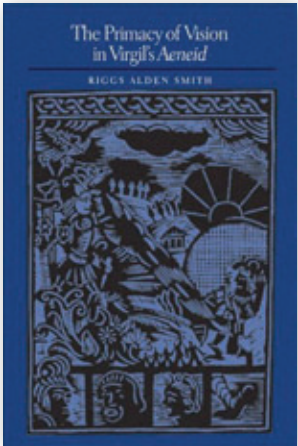
The book is lavishly illustrated with each of the major paintings depicted in color (7) and comparative paintings, sources and details in black and white (30).

Publisher: T&T Clark International | Page count: 190
Year published: 2005

The Primacy of Vision
in Virgil's *Aeneid*
By Riggs Alden Smith

Smith addresses how Virgil uses vision and visual perspectives to suggest the thoughts and motives of his characters. His topic picks up on recent emphasis on the function of visual imagery in Augustan culture in the work of Zanker and Galinsky and current interest in the visual aspects of Virgil's narrative in the *Aeneid* through such features as ekphrasis and in the presentation of the gaze in Roman literature. The book follows a large cultural hypothesis that the Augustan period in general showed a shift from republican oral culture to imperial visual culture and that the *Aeneid* is at one with Augustan monumental iconography in stressing the persuasive power of seeing rather than speaking. Smith also deploys as a key idea Merleau-Ponty's concept of the 'voyant-visible,' 'the one who sees and is seen,' and argues that the key characters of the *Aeneid* are stressed as both subjects and objects of perception.

Publisher: University of Texas Press | Page count: 271 | Year published: 2006



The Orthodox Church and
Civil Society in Russia
By Wallace L. Daniel

In the void left by the fall of communism in Russia during the late 20th century, can that country establish a true civil society? Many scholars have analyzed the political landscape to answer this question, but in *The Orthodox Church and Civil Society in Russia*, Wallace L. Daniel offers a unique perspective: Within the church are individuals who hold the values and institutional models that can be vital in determining the direction of Russia in the 21st century. Daniel tells the stories of a teacher and controversial parish priest, the leader of Russia's most famous women's monastery, a newspaper editor and a parish priest at Moscow University to explore thoroughly the transformation from communist country to a new social order. Daniel explores specific religious communities and the way they operate, their efforts to rebuild parish life and the individuals who have devoted themselves to such goals. This is the level, Daniel shows, at which the reconstruction of Russia and the revitalization of Russian society is taking place.

Publisher: Texas A&M University Press | Page count: 270 | Year published: 2006

GRADUATE DEGREES AT BAYLOR

Accounting — MAcc, MAcc/BBA, MTax, MTax/BBA
American Studies — MA
Aviation Science — IMES
Biology — MA, MS, PhD
Biomedical Engineering — BSE/MSBME, BSECE/MSBME, BSME/MSBME, MSBME
Biomedical Studies — MS, PhD
Business Administration — MBA, MBA/JD, MBA/ME, MBA/MSCS
Business Administration, Dallas, Austin — EMBA
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