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PARADIGM FOR DISCOVERY

BAYLOR STEM FACULTY
THRIVE ON RESEARCH
PARTNERSHIPS

THE MEDIUM AND THE MESSAGE

Dr. Coretta Pittman
traces echoes of protest
through popular music

SHOW AND TELL

Dr. Leslie Hahner
studies a modern
application of classical
rhetorical techniques

A DUTY TO SPEAK OUT

Baylor faculty work to
advance the cause of
religious liberty

DR. TRUELL HYDE, VICE PROVOST FOR RESEARCH

EXPLORATIONS

"...let us run with perseverance the race marked out for us."

HEBREWS 12:1

With the publication of this issue of *Baylor Research*, we celebrate a significant milestone. Fifteen years ago, Baylor established audacious goals as part of *Baylor 2012*, and then embarked on a journey to reach those goals. At that time, I accepted the position of Vice Provost for Research and did so with the commitment to press forward toward establishing Baylor as a Christian research university. I must admit that in 2002, this seemed a nearly impossible task.

Today I am amazed to see how far Baylor has come. At the same time, I continually wonder if our efforts are worthy of the extraordinary calling established in *Baylor 2012* and its successor *Pro Futuris*. Are our eyes on the mission? Are we doing all we can to further Baylor's voice in an increasingly secular world? Are we running the race with perseverance?

Looking back over the intervening years, we find answers to these questions. Faculty scholarship in the liberal arts, sciences, mathematics, engineering and the professional schools continues to deepen. The Honors College—built on the strong foundation established by longstanding liberal arts programs at Baylor—has become a powerful hub attracting influential scholars and a new generation of students pursuing their studies within the context of the centuries-old tradition of the classics.

The Baylor Sciences Building, opened and dedicated in 2004, is a beautiful and functional monument to the pursuit of excellence in science and scientific research. The Baylor Research & Innovation Collaborative (the BRIC), only a dream in 2004, has taken its place across the river and is succeeding in the daunting effort to integrate research, industry, workforce development, and

business incubation, establishing partnerships that connect Baylor to our city, our region and our state. More importantly, both the Baylor Sciences Building and the BRIC are filled with remarkable scientists and engineers offering Baylor undergraduate and graduate students research opportunities in environments that make possible entirely new ways to work, learn, and collaborate.

Each of these achievements represents a significant step forward. Viewed together, they demonstrate Baylor's unwavering commitment to the goals delineated in *Baylor 2012* and *Pro Futuris*.

Albert Einstein once described study as "the liberating influence of beauty in the realm of the spirit, for your own personal joy and to the profit of the community to which your later works belong."

In this issue of *Research*, you'll read about the philosophers, social scientists, theologians and others in Baylor's Institute for Studies of Religion, bringing their varied perspectives to bear on the issue of persecution of religious groups around the world. These Baylor scholars are part of the Religious Freedom Project, the nation's only university-based program for the analysis of religious freedom, led by Georgetown University's Berkley Center for Religion, Peace and World Affairs. Baylor students work alongside scholars at Georgetown as they study the state of religious freedom around the world and the costs to society when those liberties are not maintained. These are Baylor's "later works," shot through with the beauty of discovery and the power to change human lives.

You'll also meet faculty working collaboratively across disciplinary boundaries within Baylor interdisciplinary centers and institutes. In the Center for Astrophysics, Space Physics and

Engineering Research, mathematicians and physicists work together to share knowledge about the localization of electrons in crystal structures—an important process to the materials and electronics industries. In Baylor's Center for Spatial Research and the Center for Reservoir and Aquatic Systems Research, faculty members partner to develop "bio-inspired" solutions that will lead to advances in water-based renewable energy systems like hydroturbines. And you'll learn about a Baylor faculty member who was recently selected for a leadership role in one of the groups that manage the operation of the Compact Muon Solenoid—a major piece of instrumentation used by the European Organization for Nuclear Research (CERN). Researchers in each of these groups are engaged in international collaborations, teaming with colleagues around the globe to address issues of worldwide significance. More importantly, they are introducing Baylor students to their guild, including them in international conversations about some of the most fundamental and enigmatic concepts in the universe. Again, Baylor's "later works" are benefiting both the research community and our students.

C. S. Lewis once said, "In Science we have been reading only the notes to a poem; in Christianity we find the poem itself." From a somewhat different viewpoint, Ray Bradbury offers these words in *Fahrenheit 451*: "Everyone must leave something behind when he dies, my grandfather said. A child or a book or a painting or a house or a wall built or a pair of shoes made . . . It doesn't matter what you do, he said, so long as you change something from the way it was before you touched it into something that's like you after you take your hands away. The difference between the man who just cuts lawns and a real gardener is in the touching, he said. The lawn-cutter might just as well not have been there at all; the gardener will be there a lifetime." One of the great differences in how research occurs at Baylor should be in the way our hands touch the garden we are tending. As we continue to make research a priority, the harvest will continue for generations to come.

Those of you who have known me for any time at all know that the pursuit of a Christian research university—establishing a city on a hill—resonates with me. In Ecclesiastes 9:10, we find this observation: "Whatever your hand finds to do, do it with all your might, for in the realm of the dead, where you are going, there is neither working nor planning nor knowledge nor wisdom." Baylor faculty are indeed doing their work "with all their might," and increasingly the Baylor voice is being heard in academic and government venues across America and around the world.

In the first issue of *Research*, published in 2004, I wrote the following words, and I believe they still hold true today:

"The idea of a Christian research university and the accompanying tension between faith and intellect is nothing new to the academy. C. S. Lewis, who fought for the restoration of a vital Christian voice in the highest levels of academic life, went straight to the heart of the matter when he said in 'The Weight of Glory': 'A man who has lived in many places is not likely to be deceived by the local errors of his native village; the scholar has lived in many times and is therefore in some degree immune from the great cataract of nonsense that pours from the press and the microphone of his own age.'"

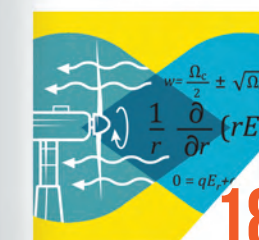
As I have done in so many issues of *Research* over the years, I'll close with the following: In these pages, you'll find the merging of faith and intellect well underway within the laboratories and offices and classrooms across the Baylor campus and the Baylor voice at home and abroad stronger than it has ever been.

Please feel free to contact me to learn more or visit Baylor's Research website at www.baylor.edu/research.

THE BEST IS YET TO COME!

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INTROSPECTION

A LOOK AT
IDEAS, WRITINGS, AND
PEOPLE OF NOTE
WITHIN THE BAYLOR
RESEARCH COMMUNITY

DR. PATRICK FARMER
IS THE PRINCIPAL
INVESTIGATOR ON A
GRANT DESIGNATED
FOR PURCHASE OF AN
ELECTRON PARAMAGNETIC
RESONANCE (EPR)
SPECTROMETER. EPR
CAN BE USED TO
RESEARCH DISEASES
LIKE ALZHEIMER'S
AND PARKINSON'S.



LOOKING INWARD, REACHING OUTWARD

NSF-FUNDED EQUIPMENT PROVIDES SCIENTIFIC DATA AND OUTREACH OPPORTUNITIES

A team of Baylor researchers now has a window into a broad variety of cellular processes thanks to a Major Research Instrumentation grant from the National Science Foundation. The grant provided over \$240,000 for the acquisition of an electron paramagnetic resonance (EPR) spectrometer.

Dr. Patrick Farmer, professor and chair of the department of chemistry & biochemistry in Baylor's College of Arts & Sciences, is the principal investigator on the grant. He says the uses of the EPR device are wide-ranging, with potential benefits for faculty research as well as undergraduate and graduate education in a variety of fields including chemistry, biology and geosciences.

EPR is used to detect unpaired, or "free," electrons, yielding detailed information on the geometric and electronic structure of molecular and solid-state materials. Chemical species with unpaired electrons are known as "free radicals," and they are involved in many important biomedical processes.

"The EPR is a tool widely used by biochemical or medical researchers to look at cellular processes and the chemistry involved in those processes," Farmer explains. "Free radicals are involved in processes like vascular signaling, which impacts control of blood pressure; oxidative stress, which causes irreparable damage to cells as part of the aging and disease process; and neurodegenerative diseases like Alzheimer's and Parkinson's."

THE PRESENCE OF THE EPR

is not just a benefit to faculty and students who work on Baylor's campus. The department of chemistry and biochemistry also utilizes the device as part of its Advanced Instrumentation Workshops, an outreach program that Farmer and his colleagues in the chemistry department have organized and hosted at Baylor for the last nine years.

The EPR was a central component of the most recent workshop. Baylor faculty presented EPR theory in pre-lab sessions, then let students use the device to study simple compounds.

Throughout its history, the Advanced Instrumentation Workshop has provided hundreds of students with hands-on, faculty-led instruction using Baylor lab equipment. The students and faculty come from institutions in New Mexico, Texas, Louisiana and Arkansas. Funds from a variety of Baylor sources including the Office of the Vice Provost for Research cover travel and lodging costs for visiting undergraduates and their faculty advisors. Nearly a third of students who have attended have been under-represented minorities and roughly half have been women.

"The workshop provides students and their faculty mentors from smaller schools with exposure to instrumentation that is generally lacking at their home institutions," Farmer says. "The NSF places a strong priority on making sure the benefits of research are disseminated as broadly as possible. The workshop is one of the ways that we support that goal as a department and as a university."



BOOKENDS



1

1

"TAKING RITES SERIOUSLY: LAW, POLITICS, AND THE REASONABLENESS OF FAITH"

Dr. Francis J. Beckwith, professor of philosophy
In "Taking Rites Seriously" Beckwith argues that religious beliefs and believers are sometimes mischaracterized by judges and legal scholars who are critical of the role of religion in politics and in the formation of the law. He carefully addresses contentious legal and cultural questions over which citizens often disagree. These topics include the rationality of religious belief, religiously motivated legislation, human dignity in bioethics, reproductive rights, and evolutionary theory.

2

"SHAKESPEARE'S POLITICAL WISDOM"

Dr. Timothy Burns, professor of political science
Among the many themes that appear in the plays of William Shakespeare are the ideas of justice and the proper exercise of power. Burns interprets five Shakespearean plays to reveal the guidance these works can provide to our contemporary political life. "Shakespeare's Political Wisdom" was named a winner of the 2014 CHOICE Outstanding Academic Titles award.

3

"SACRIFICING CHILDHOOD: CHILDREN AND THE SOVIET STATE IN THE GREAT PATRIOTIC WAR"

Dr. Julie deGraffenried, associate professor of history
During the Soviet Union's Great Patriotic War, the Stalinist vision of a state-nurtured "happy childhood" was upended as children faced deprivation, violence and death. By chronicling the wartime experiences of children and the role of the state in shaping their worldview, deGraffenried fills a neglected niche in the history of the Soviet Union and World War II.

4

"ELEGY ON KINDERKLAVIER"

Arna B. Hemenway, M.F.A., assistant professor of English
Hemenway's debut work is a collection of short stories and a novella. Many of the stories involve soldiers who are serving, or recently returned home from serving, in Iraq. The novella tells the story of a young couple whose son has a terminal brain tumor. "Elegy on Kinderklavier" was awarded the PEN/Hemingway Award for a Distinguished First Work of Fiction, the nation's most prestigious award for debut fiction.

GRANTING SUCCESS

YOUNG BAYLOR INVESTIGATORS ARE EARNING RECOGNITION—AND GRANTS—FROM TOP GOVERNMENT AGENCIES.

There's no way around the fact that research is a very costly enterprise. It requires expensive equipment and special facilities, and it takes decades for researchers to gain the education and experience necessary to make strides in their chosen fields. Federal agencies like the National Science Foundation and the National Institutes of Health once provided more than half the dollars spent on research and development in America. Today, that percentage has fallen to little more than a third.

Although federal funding is getting tighter, the NSF, NIH and other federal funding agencies continue to invest in the careers of bright young investigators who have demonstrated exemplary ability and whose areas of research offer the potential to solve particularly vexing scientific and technical problems.

In recent years, two Baylor researchers have earned five-year, NSF Faculty Early Career Development awards—commonly called "CAREER grants"—for work in vastly differing fields. Dr. Lorin Swint Matthews, an assistant professor of physics in the College of Arts & Sciences and associate director of Baylor's Center for Astrophysics, Space Physics and Engineering Research (CASPER), received her \$405,000 CAREER award to investigate the electrical and other forces that cause particles in the dusty ring that surrounds young stars to clump together, ultimately forming asteroids and planets. Despite its distinctly cosmic focus, Matthews' research has the potential to expand our understanding of particle-laden plasmas here on Earth, where they are used in many industrial and medical processes.

The research topic that won Dr. Bryan Shaw his NSF CAREER grant also involves electrical charges, but on a vastly different scale. Shaw, an assistant professor of



DR. BRYAN SHAW WAS AWARDED A GRANT TO EXPLORE THE ROLE ELECTRICAL CHARGES IN METALLOPROTEINS PLAY IN THE DEVELOPMENT OF ALZHEIMER'S & ALS.



biochemistry in the College of Arts & Sciences, believes that a very small change in the overall charge of metalloproteins—proteins that contain metals—may keep them from combining into the harmful plaques found in the brains of Alzheimer's and ALS sufferers. Part of his award also will go to expand a project he developed that uses a 3D printer to create enlarged models of proteins to help blind and other sight-disabled students "visualize" these complex structures.

THE NATIONAL INSTITUTES OF HEALTH

and some of its constituent organizations have similar programs. Dr. Shawn Latendresse, assistant professor in Baylor's department of psychology and neuroscience, received a Career Development award from the NIH's National Institute on Alcohol Abuse and Alcoholism in support of his research into how people succumb to alcoholism. His five-year, \$811,648 grant will fund the use of a method known as Integrative Data Analysis to uncover new relationships from data gathered during previously conducted long-term studies.

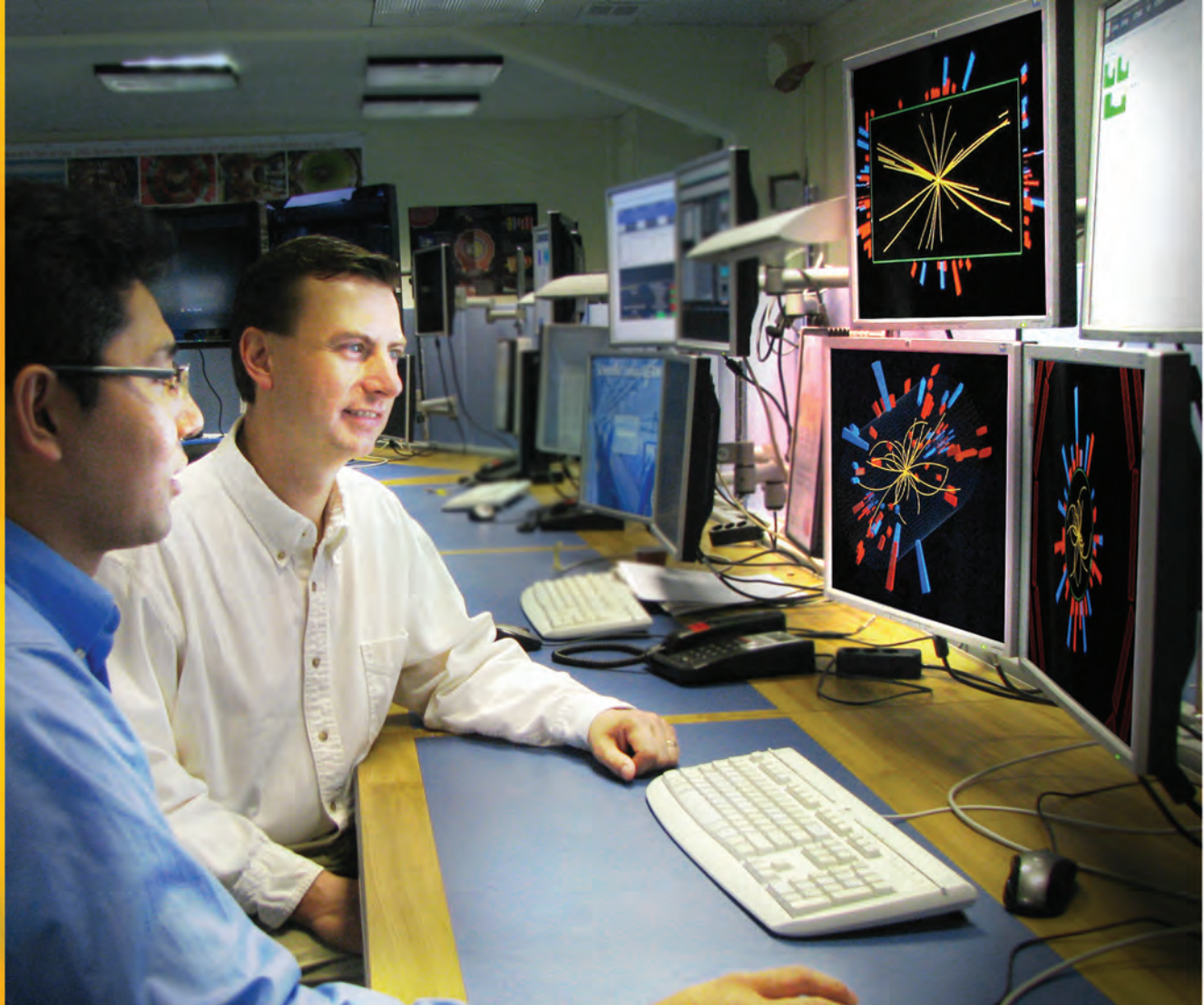
And it's not only scientists who have their work recognized with these special grants; engineers also have their work singled out for support. Dr. Joseph Kuehl, an assistant professor of mechanical engineering in Baylor's School of Engineering & Computer Science, recently was awarded a three-year Young Investigator Program grant from the Air Force Office of Scientific Research. Kuehl's proposal for hypersonics research was chosen from over 200 submitted in competition for the \$359,000 grant. His work will improve understanding of how turbulence develops during extreme high-speed flight, perhaps paving the way for a new generation of aircraft that can circle the globe in only a few hours.

DR. LORIN SWINT MATTHEWS EARNED AN AWARD TO INVESTIGATE HOW ELECTRICAL FORCES INFLUENCE THE FORMATION OF ASTEROIDS AND PLANETS.



DR. JOSEPH KUEHL WAS AWARDED A GRANT FOR WORK TO IMPROVE UNDERSTANDING OF HOW TURBULENCE DEVELOPS DURING HIGH-SPEED FLIGHT.





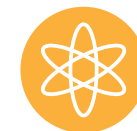
MANAGING A GOING CONCERN

BAYLOR PHYSICIST LEADS A MANAGEMENT TEAM AT A PRESTIGIOUS EUROPEAN RESEARCH FACILITY

Travelers touring Geneva, Switzerland, may pause to consult their guidebooks and admire majestic views of the Alps and Jura mountains surrounding the city without the slightest notion that some 400 feet below them two streams of subatomic particles are hurling at unfathomable speed toward a cataclysmic collision.

Geneva is home to CERN, the European Organization for Nuclear Research, an international collaboration among 21 member states and over 500 academic institutions and corporations. CERN operates the Large Hadron Collider (LHC), the world's largest scientific instrument and its most powerful nuclear accelerator. It was the LHC that produced the first evidence of the long-sought-after Higgs boson in 2012.

The LHC consists of four circular tunnels of increasing size, the largest of which is well over 16 miles around. It is within this large ring that subatomic particles—usually protons—are propelled in opposite directions to more than 99.9 percent the speed of light before superconducting magnets steer them onto a single path. The resulting collision produces a dizzyingly complex spray of fragmented particles.



DATA ON THE PARTICLES' CHARGE,

spin direction and other attributes—millions of gigabytes of it per year—is recorded by massive yet highly sensitive detectors such as the Compact Muon Solenoid (CMS), which weighs over 14,000 tons. Two Baylor physicists, Dr. Jay Dittmann and Dr. Kenichi Hatakeyama, have been working with the CMS collaboration at CERN since 2010. Both Dittmann and Hatakeyama are associate professors of physics in Baylor's College of Arts & Sciences.

This past summer, Dittmann was named deputy project manager of the team that manages the Hadron Calorimeter, or HCAL, a key component of the CMS. The HCAL measures the energy present in hadrons, a specific class of subatomic particles—such as protons and neutrons—that are made of quarks, anti-quarks and gluons.

In his new role, Dittmann will oversee the HCAL's Data Performance Group (DPG), one of three subgroups assigned to manage various aspects of the HCAL's operation. The DPG is the subgroup concerned with calibrating and validating data, as well as with designing the computer algorithms used to render the data into plots, histograms and other forms for analysis.

"The DPG is continuously looking at the new data that comes in. We're interested in seeing that everything looks as expected," Dittmann explains. "In some cases we have to apply corrections to the data to account for known characteristics of the detector. There's a whole set of activities that falls under that subgroup."

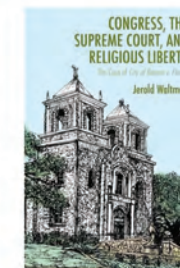
While CERN's Large Hadron Collider generates huge volumes of data that relate to many topics in elementary particle physics, Dittmann says he is primarily focused on one of the most enigmatic concepts in the cosmos—dark matter.

"There are several models that could explain what dark matter is. Right now supersymmetry is one of the best candidates we have for describing particles and forces in our universe. The standard model has done a very good job of explaining the universe for decades, but supersymmetry is a kind of superset of the standard model that could help solve some other mysteries," he said.

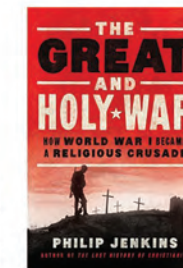
BOOKENDS



5



6



7

5

"THE PRICE OF VALOR"

Dr. David A. Smith, senior lecturer of history

When he was 17 years old, Audie Murphy lied about his age so that he could enlist in the Army and help in the fight against Nazi Germany. From there, he became the most decorated hero of World War II. "The Price of Valor" is the first biography to cover Murphy's entire life, from his single-handed stand against the Germans at the Battle of Colmar Pocket to his later struggles with post-traumatic stress disorder and his tragic death at age 45.

6

"CONGRESS, THE SUPREME COURT, AND RELIGIOUS LIBERTY: THE CASE OF CITY OF BOERNE V. FLORES"

Dr. Jerold Waltman, professor of political science

When Catholic Archbishop Patrick Flores was denied a building permit to expand St. Peter's Church, he probably never imagined he was setting in motion a chain of events that would culminate in a landmark piece of American jurisprudence. But Flores' dispute with the City of Boerne, Texas, began a legal battle that would end with the U.S. Supreme Court invalidating provisions of the 1993 Religious Freedom Restoration Act. Waltman uses this conflict as the backdrop for a broader examination of the current state of religious liberty debates in the United States.

7

"THE GREAT AND HOLY WAR: HOW WORLD WAR I BECAME A RELIGIOUS CRUSADE"

Dr. Philip Jenkins, distinguished professor of history

At the one-hundredth anniversary of the outbreak of World War I, Jenkins explores the powerful religious dimensions of the so-called "war to end all wars." Jenkins reveals how the widespread belief in angels and apparitions, visions and the supernatural was a driving force throughout the war and how this belief shaped all three of the major religions—Christianity, Judaism and Islam—paving the way for modern views of religion and violence.



THE MEDIUM AND THE MESSAGE

BAYLOR ENGLISH PROFESSOR
DR. CORETTA PITTMAN
TRACES ECHOES OF PROTEST
THROUGH POPULAR MUSIC



BESSIE SMITH PLATO ARISTOTLE COMMON



Mural art: Dave Loewenstein, lead artist



DR. CORETTA PITTMAN, ASSOCIATE PROFESSOR OF ENGLISH IN BAYLOR'S COLLEGE OF ARTS & SCIENCES, GREW UP WITH MUSIC ALL AROUND HER.

"My father loves music, and he played it in the house all the time," she says. "He would play soul and R&B from the sixties and seventies, groups like The O'Jays, Marvin Gaye and Stevie Wonder. He had a vinyl LP of 'Led Zeppelin IV' and we listened to 'Stairway to Heaven' over and over while we did chores on Saturday mornings."

As a teenager, Pittman began to encounter artists whose music carried different messages from the ones she heard from her father's records and tapes. Watching shows like "Yo! MTV Raps" and sharing cassette mix tapes with her friends, she became exposed to music that pushed boundaries and widened her perspective on the persuasive nature of music and the messages it could carry.

While working on her Ph.D. in rhetoric and composition at Wayne State University, Pittman began to see parallels between the persuasive and rhetorical techniques analyzed by classical thinkers like Plato and Aristotle and those employed by African American musical artists.

Aristotle defined rhetoric as "observing in any given case the available means of persuasion," and Pittman says that throughout much of American history, music was often the only means of persuasion available for African Americans and other marginalized groups.

"Historically, music and art are ways that African Americans can be involved in mainstream culture," she says, "even when they had no other way to enter public discourse." Pittman analyzes the way musicians from the early 20th century to the present have used music as a form of protest, specifically examining the connections between the rhetoric of black activists and the lyrics of hip hop and rap artist Common. Both black activists and rap artists, Pittman says, are considered outsiders to mainstream American culture and use that position to challenge discrimination and racism.

While their rhetoric is sometimes considered extreme, they consider the bold character of their speech necessary for those in a position of powerlessness if they want their message heard not only within their own communities, but in the cultural mainstream as well.

That necessity continues to exist today as racially or socially marginalized groups struggle to make their experiences relevant to a majority culture that may not recognize other perspectives as valid. Music offers a unique platform from which African Americans can take their message directly to multi-cultural audiences.

The basic message of a lot of protest music, Pittman says, is "listen to me." "In the 1980s, for example, it was only through rap music that marginalized people were able to have a voice to say, 'Hey, the Civil Rights Movement didn't work for everyone. We're still here.'"

PITTMAN'S STUDY OF MUSIC AS A TOOL OF PERSUASION DOESN'T END WITH HER OWN RESEARCH.

She encourages her students to think critically about contemporary music and the arguments presented by the artists. One of her favorite courses to teach is focused on applying Plato's analysis of rhetoric and truth to the study of jazz artists like Bessie Smith. She encourages her students to look critically at their own favorite artists to understand their perspectives.

Her goal is to help her students see the persuasive efforts at work in all forms of art, not just the written word.

"There are a lot of different ways writers, musicians and artists can make arguments," she says. "So I think it's important that we not ignore contemporary art. Basically, I love rhetoric, I love music and I love literature, so it makes perfect sense for me to study them all together."



SHOW AND TELL

BAYLOR PROFESSOR
DR. LESLIE HAHNER
STUDIES A MODERN
APPLICATION OF
**CLASSICAL
RHETORICAL
TECHNIQUES**



YES MA'AM, I RECKON THIS WILL GO VIRAL.

A
PICTURE,
THEY SAY,
IS WORTH
A THOUSAND
WORDS.

That's never been more true than it is in today's 24-hour news cycle, where news is more often watched than read. Headlines may come and go, but powerful news images can become part of the public consciousness almost instantaneously. Iconic images become closely identified with a news event, but not everyone perceives and interprets the images—or the stories they tell—in the same way.

Dr. Leslie Hahner, associate professor of communication in Baylor's College of Arts & Sciences, says that while studying images and the way people react to them is not new, recent advances in communication technology have changed the ways in which audience members can repurpose images to give them meaning beyond those originally intended by the photographer. Thanks to the power and reach of the Internet, images can spread rapidly and take on lives of their own, opening up new avenues for academic inquiry.

"Traditionally, visual rhetoric scholars study the image itself and question how the audience is invited to view the image and respond to it. What's new about this analysis is that we now have access to so many different ways in which

people can repurpose images to give a different framework for viewing their responses."

Prior to the last few decades, modifying an image involved lots of specialized equipment and skill. The resources required made image manipulation the province of professionals and left most would-be commentators with only low-tech tools like scissors and paste.

Now, thanks to the rapid spread of image-manipulation software, virtually anyone with a computer can change an image to cast the subject in a different light. Internet users can manipulate images in seconds, adding text commentary, superimposing new elements into the picture, or placing the subject of the picture in a completely different scene. When users create and share these images, it can spark a rapid-fire give-and-take where one viewer takes the ideas of another and adds his or her own touches before sending the image into the world. When these images, themes and comments begin to coalesce around a central idea, a meme – a cultural artifact in the form of an image or phrase that spreads quickly and is altered in a creative or humorous way – is born.

ONE PARTICULAR IMAGE

that has been the focus of Hahner's research was taken in the riots following the Vancouver Canucks' Stanley Cup win in 2012. The image, which became widely referred to as "Riot Kiss," shows a city street at night with a couple kissing on the pavement while riot police look on. Viewers responded to the image in a multitude of ways: some saw it as an iconic juxtaposition of romance against a violent encounter with police, while others claimed that the image was staged or fabricated entirely.

In the days following the photograph's publication, Internet users began to manipulate the image to place the kissing couple in a wide range of other familiar photographs: next to the row of tanks in Tiananmen Square, behind the Beatles crossing Abbey Road or on the shoulder of the highway where O.J. Simpson led police on a low-speed chase (the list goes on and on – while we'd love to show you some of these images, unfortunately, due to the uncertain authorship of these works, it is impossible to properly attribute them for copyright purposes). Some of these visual mashups are simply intended to make a silly joke, while others provide serious commentary on the event itself, journalistic integrity and the nature of authenticity in visual art. These repurposings, Hahner says, illustrate the myriad frames through which individuals can view an image and the arguments it presents.

While online memes like "Riot Kiss" are a recent development, they channel a classical rhetorical technique known as enthymeme, a rhetorical construction in which the speaker doesn't explicitly state all parts of an argument and instead requires viewers to come to a conclusion on their own.



"Enthymemes are very persuasive because they invite the audience to do some of the work for the speaker," Hahner explains. "The trick for a scholar or teacher of visual rhetoric is to make sure we recognize whether the particular image we're seeing is an ethical form of persuasion or not."

As both a scholar and a teacher, Hahner applies what she learns in her research to the undergraduate and graduate classes she teaches. That connection between research and teaching has also opened up opportunities for undergraduate students to pursue independent research projects of their own.

Rachel Reon, a senior majoring in communication studies, has worked with Hahner on research related to visual arguments for the past three years. In that time, she has had the opportunity to present her research at Baylor's Scholars Week (an undergraduate research showcase) as well as at professional academic conferences. She and Hahner have even been co-authors on a scholarly paper related to the work.

Reon says that participating in research alongside Hahner has helped her clarify her ultimate career goals.

"Working with Dr. Hahner has really confirmed my decision to go to graduate school," Reon says. "She pushed me to work at a higher level and gave me the freedom to explore concepts and learn on my own. That accountability and freedom gave me the confidence to write at a higher level."



PARADIGM FOR DISCOVERY

BAYLOR STEM FACULTY THRIVE ON RESEARCH PARTNERSHIPS

Like faculty at most research institutions today, Baylor researchers in the STEM fields—science, technology, engineering and mathematics—long ago learned that joining forces with colleagues both inside and outside the institution results in a sum of accomplishments that is much greater than its parts. That’s especially true of early- to mid-career investigators whose formative years in training were spent in the interdisciplinary environments that so often characterize research institutions. Some bring with them to Baylor longstanding partnerships, while others find opportunities to develop partnerships with new colleagues with whom they share common research interests.



PLASMA CRYSTAL RESEARCH

DR. CONSTANZE **LIAW**

MATHEMATICS

DR. LORIN **MATTHEWS**

PHYSICS

GOOD EXAMPLE

of the latter is assistant professor of mathematics in Baylor's College of Arts & Sciences, Dr. Constanze Liaw, the latest addition to the roll of research fellows in CASPER—Baylor's Center for Astrophysics, Space Physics and Engineering Research.

Liaw came to Baylor in 2012 after a three-year stint as a visiting assistant professor of mathematics at Texas A&M. A native of Germany, she holds an undergraduate degree from the University of Stuttgart and graduate degrees—including a Ph.D.—from Brown University in Rhode Island. She is a "pure" mathematician by training and preference, but a recent chance conversation between her husband, Baylor assistant professor of mechanical engineering, Joe Kuehl, and CASPER director Truell Hyde, drew her into the realm of applied mathematics.



"Dr. Hyde was describing some research he is doing into plasma crystals, which are hexagonal in shape. Joe said, 'Oh, Conni does stuff with hexagonal structures.' Somehow Dr. Hyde was interested and we set up the first meeting."

She began attending weekly CASPER research reviews and started meeting with CASPER associate director and assistant professor of physics, Lorin Matthews. As the two became more familiar with each other's work, a system began to take form that spanned the three main branches of physics research: numerical, analytical and experimental. Matthews applies numerical models that simulate the behavior of dusty plasma crystals to data from previous experiments. She then hands off the results to Liaw, who performs a detailed mathematical analysis to determine what those results actually reveal. The two then work together to guide CASPER's physicists in conducting new experiments that will further refine our understanding of plasmas, the most common form of matter in the universe.

PART OF THEIR WORK

relates to *Anderson localization*, a phenomenon named for American physicist and Nobel laureate P. W. Anderson, which relates to the "localization" of electrons in a crystal. It is a process important to the materials and electronics industries where a thorough understanding of the behavior of electrons in crystalline materials, such as graphene, is key.

Though Liaw would be the first to agree that mathematicians tend to be a reclusive lot, they do enjoy getting together to learn from each other. This past summer, she and three colleagues organized a small gathering of top international mathematicians at the prestigious Mittag-Leffler Institute in Stockholm, Sweden. Liaw also applied for and was awarded a National Science Foundation grant that allowed several rising young American mathematicians to "meet in this very private setting with the superstars in the field," she says.

As you might imagine, gatherings of mathematicians are considerably more sedate than the typical conference.

"The Institute is like a small castle and it's very quiet. The walls in every room are filled with books. Meals are furnished and there are little apartments there; it's all very beautiful. You don't have to worry about anything," she says. "Everybody just talks about mathematics all day."

Liaw admits that, as much as she loves the often solitary nature of mathematics work, she most enjoys working with students one-on-one or in small groups. It is a love that began in the eighth grade when she was asked to tutor a younger student. She continued tutoring all the way through completion of her Ph.D.

"I taught huge classes at (Texas) A&M; that was less fun. When I came here, the smaller classes were awesome. Now I'm working with undergraduate and graduate students in a more personal setting. I really enjoy that."

$$\pm \frac{\Omega_c}{2} \pm \sqrt{\Omega_c^2/4 - qE_r/mr}$$

$$\frac{1}{r} \cdot \frac{\partial}{\partial r} (rE_r) = qn/\epsilon_0$$



$$0 = qE_r + qv_\theta B + mv_\theta^2/r$$

WATER-BASED RENEWABLE ENERGY

DR. SCOTT JAMES

DR. JOE KUEHL

GEOSCIENCES

MECHANICAL ENGINEERING

COLLABORATIONS can also form spontaneously between researchers whose interests simply mesh at first meeting. That's what happened to two Baylor

researchers who met during their first semester on the Baylor faculty.

It took a couple of years for Dr. Joe Kuehl, assistant professor of mechanical engineering in Baylor's School of Engineering & Computer Science, to follow his mathematician wife, Conni Liaw, up Texas Highway 6 from Texas A&M and College Station to Waco. With doctorates in both oceanography and mechanical engineering, Kuehl had been researching ocean currents and hypersonics for nearly five years in Aggieland when a spot opened up at Baylor. Kuehl's experience in fluid dynamics fit the bill, and then some.

Dr. Scott James, assistant professor of geosciences in the College of Arts & Sciences, came to Baylor from a private water resources company he joined after an eleven-year stint at Sandia National Laboratory's Soil and Sediment Transport Laboratory. A registered professional engineer as well as a geologist, James became a master modeler of the movement of water, air and the massive volumes of particulate matter they carry from place to place.

Kuehl and James found themselves in the same faculty orientation class in August 2014, and the pieces began to fall in place immediately.

"I was the last of a five-professor hire for CRASR—the Center for Reservoir and Aquatic System Research—and that was designed to be a multidisciplinary hire," James recalls. "Part of the orientation process was to talk about what our areas of interest are. When I heard what Joe was doing I thought, 'I've got to sit next to this guy at lunch to talk about projects. We have a lot in common in our background.'"

"I trained as what you'd call a blue-water oceanographer," Kuehl explains. "I do large-scale geophysical fluid dynamics. Scott does a lot of modeling of flows and mixing processes in ground water and surface water. Now he is kind of moving toward off-shore and I'm trying to work my way inland. So we are meeting in this estuary kind of interface, what we call 'muddy water.' That opens up some really interesting ways of looking at problems because, even though we could both look at the same region, we each have a different view of what's going on and can come up with what we hope are some creative solutions."

"Right," James agrees. "I've done a lot of simulations on reactive flow and transport in surface and ground water systems, and Joe's done experimental work in those areas. It was a perfect match to put the modeler and the experimentalist together."

The two are applying their complementary skillsets to a variety of problem areas, including water-based renewable energy systems such as hydroturbines, large whirling devices that, when anchored in rivers, tidal regions or swiftly moving ocean currents, work like underwater windmills to generate electrical power.

WATER IS a much steadier and more predictable source of energy than wind, but it's also problematic in different ways. One of the big problems with water-powered systems is keeping them moored to the river bottom or sea floor. The constant pressure of the current and movement of the spinning, multi-ton devices take a toll on restraints and they soon work free. The researchers are looking to trees as a possible "bio-inspired" solution.

"You've seen pictures of a tree in a waterfall where the water is flowing all around the tree; how does it stay there?" James asks. "We think it's because the tree's roots are sucking up the moisture, drying up the soil. That keeps the tree in place. We're working to apply the same principle to moorings by developing a way to keep the sediment around the restraint from fluidizing, allowing it to pull free."

The pair also are working with a third Baylor researcher to form a new Geophysical Fluid Dynamics Group that draws on Baylor expertise across an unprecedented range of fields.

"Most of the impetus for that came from Bruce Byars," James says. [Byars is the director of Baylor's Center for Spatial Research.] "He's getting all of us together who have common interests to form a research group that will solve geophysical fluid dynamics problems that range everywhere from flows of magma in the Earth's core all the way up through the atmosphere. So we'll span the entire range of environmental flows."

"Actually," Kuehl adds, "[Baylor Institute for Air Science director] Dr. Trey Cade knows space weather. If you take in all the rest of us, we fill in the full spectrum from magma flows up to the solar wind and everything in-between; it certainly has potential."

F COURSE,

many collaborations are simply natural combinations of interest

and talent between researchers who've known each other for years. Dr. George Cobb, professor and chair of environmental science in the College of Arts & Sciences, arrived at Baylor in 2011 to take over the reins of the department, having already been a close colleague of Dr. Bryan Brooks for years. Brooks had landed at Baylor almost a decade earlier, and it was partly on Brooks' recommendation that Cobb was brought in as chair.

"We've been interacting professionally for seventeen, eighteen years now," says Brooks, who is also a professor of environmental science in the College of Arts & Sciences. "When our chair came open I recommended George to the dean not just because of my knowledge of his work, but partly because earlier he'd expressed concern to me privately that, if he were chosen, he'd want to be allowed to continue to help a few students at his current university finish out their degrees. He was doing the right thing for the right reasons, thinking about the students' interests."

Doing right by the students has always been a core principle for Baylor faculty, but the dean's choice of chair turned out to be a good fit in other ways too. Cobb had been collaborating internationally for years before coming to Baylor. At the same time, Brooks had long recognized that environmental problems can't be constrained by borders—or even confined to continents—and had begun steadily building an international presence and reputation.

"When I got here in 2002, I was working on some topics that really nobody in the U.S. seemed to care about, but in Europe they were a big deal," Brooks says. "So I asked the dean for some travel money so I could go interact with the Europeans, primarily. We're working on five continents now and developing a proposal for a sixth."

"George has been really important in developing a department-wide culture of international collaboration. The slogan for our department now is, 'Global scope, global impact.'"

During Cobb's tenure, those early treks across the Atlantic have led to active agreements, research projects

INTERNATIONAL COLLABORATION

DR. BRYAN **BROOKS**

DR. GEORGE **COBB**

ENVIRONMENTAL SCIENCE

ENVIRONMENTAL SCIENCE

and exchange programs with several countries in Europe, Latin America and the Pacific Rim, where researchers have just wrapped up a project in New Zealand. They recently secured the first research funding between Baylor and Hong Kong Baptist University, a long-time sister institution. Other faculty members are initiating air and water quality projects with colleagues in China.

"What I'm doing in the way of international engagement personally right now is relatively minor," Cobb says. "As chair, though, I'm trying to serve as a catalyst to encourage

people to find resources and to help our people do what they need to do."

In addition to the reams of good science coming out of these arrangements, they have opened a pipeline for stellar exchange students who want to study at Baylor.

"We've recently had two students from Latin America come work with us, and a third is coming this fall. There is a Ph.D. student from New Zealand and a visiting Ph.D. student in the lab right now from China—she's already published!" Brooks says.

In whatever way research partnerships may form, Baylor researchers find their talents and experience multiplied and magnified by a natural combining of complementary experiences and interests.



A DUTY

**BAYLOR FACULTY MEMBERS WORK TO ADVANCE THE CAUSE OF
RELIGIOUS LIBERTY**

▶ **IN HIS LETTER FROM BIRMINGHAM JAIL,**

Dr. Martin Luther King responded to critics who questioned why he – an “outsider” to the city of Birmingham – was becoming involved in nonviolent protests by African Americans against the town’s business and government leaders. Wouldn’t it be better, the critics suggested, for him to use his influence in other areas? But for King, remaining at home in Atlanta and ignoring events in Birmingham was simply not an option. To remain silent, he felt, would give tacit approval to injustice.

“We will have to repent in this generation,” he wrote, “not merely for the hateful words and actions of the bad people but for the appalling silence of the good people.”

Just as King felt an obligation to speak out for victims of discrimination in Birmingham, many scholars now feel a duty to shine light on the problem of religious persecution around the world.

Violations of religious liberty can take many forms ranging from restrictions on religious practices to more severe persecution that can place adherents of a particular religion at risk of losing their jobs, their property or even their lives. According to the Pew Research Center, over three-fourths of the world’s population live in areas with high levels of government restrictions and social hostilities toward particular religious groups.

TO SPEAK OUT

In the face of these dangers, Baylor faculty members from a variety of disciplines are conducting research and advocacy aimed at protecting the freedom of religious groups around the world.

A MULTIDISCIPLINARY PERSPECTIVE

Dr. Francis Beckwith, professor of philosophy in Baylor’s College of Arts & Sciences, originally came to Baylor to teach classes and conduct research as part of the university’s Institute for Church-State Studies, which functioned as a think-tank focused on issues that arise between religion and government. He is currently affiliated with Baylor’s Institute for Studies of Religion, where he is one of dozens of scholars who examine issues of faith from a wide range of perspectives. That multidisciplinary background, he says, allows for more nuanced understandings than could be reached in a less diverse environment.

“I think a multidisciplinary approach is important because we can get perspectives from one discipline that we don’t get from another,” explains Beckwith, who holds a master of judicial studies degree from Washington University in St. Louis in addition to his Ph.D. in philosophy from Fordham University.

By blending legal and philosophical perspectives with social scientific analysis, Beckwith and his ISR colleagues can tackle broad philosophical questions without missing the day-to-day concerns that often plague issues of religion and society.

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—DR. FRANCIS
BECKWITH
PROFESSOR OF
PHILOSOPHY



"Lawyers have practical wisdom that helps them anticipate pragmatic concerns that philosophers may not see. Philosophers can illuminate the understanding of lawyers when they think about big questions; social scientists can ask questions about the day-to-day experiences of believers that wouldn't occur to philosophers."

While a community of scholars studying issues of religious liberty is valuable on its own, Beckwith says the true benefit of Baylor's work in this area occurs only when it translates into results that make a difference in the lives of ordinary people.

"Great movements begin with talking," he says, "but they have to reach a critical mass and get people's attention. All the academic writing in the world won't help unless it is put in front of people with political or religious power. I write law review articles because they end up being picked up by judges and legislators. That's when these ideas ultimately get attention."

A PARTNERSHIP FOR SUCCESS

Baylor's advocacy for religious liberty isn't limited to work on the Waco campus. The ISR partners with Georgetown University's Berkley Center for Religion, Peace and World Affairs as part of the Religious Freedom Project (RFP), the nation's only university-based program devoted exclusively to analysis of the state of religious freedom.

RFP was founded at Georgetown in 2011 with support from the John Templeton Foundation. Baylor's Institute for Studies of Religion became a partner in 2014. Scholars affiliated with the partnership conduct research on the current state of religious liberty around the world as well as

broader studies on the impact of these freedoms and their restriction on society.

The partnership between Baylor – the world's largest Baptist university – and Georgetown – the nation's oldest Catholic Jesuit university – is a natural fit, according to Dr. Byron Johnson, distinguished professor of social sciences and the co-director of Baylor's ISR.

"We don't think it's an accident that Catholics and Protestants are working together on these issues," he says. "When you bring these two groups together, we can do more than we can separately."

Johnson is careful to point out that while the two universities are both Christian, their inquiry and advocacy are intended to improve conditions for members of all faith groups.

"We don't conceal the fact that we're Christian, but we think freedom to believe is important for everyone – whether they are Jewish, Muslim, Hindu or have no religion at all. There's a real need to produce good, peer-reviewed research that reasonable people can look at to understand the current state of religious liberty around the world."

In addition to publishing academic work, RFP also holds conferences and meetings where scholars present their findings. Their events, often held in Washington on Georgetown's campus, draw attendees and participants from around the world, including legal experts, policy analysts, and religious leaders from a wide range of faith traditions. Johnson says that reaching these audiences, as well as journalists and government officials who attend the meetings, is critical to help spark discussion on religious liberty issues.

AN OBLIGATION TO HELP

Frank Wolf didn't consider human rights his most important legislative priority when he first won election to the U.S. House of Representatives. In 1980, when voters from Virginia's 10th Congressional District sent him to Washington, he was most concerned with issues related to transportation and infrastructure. But when a close friend in Congress, Representative Tony Hall from Ohio, invited him on a trip to Ethiopia in 1984, Wolf had what he calls a "life-changing experience." Seeing conditions in the famine-stricken country first-hand left him with the conviction that the United States could not remain idle in the face of such profound human suffering.

Retiring in 2014 after his 17th term in Congress, Wolf was named Baylor University's Jerry and Susie Wilson Chair in Religious Freedom. In that role, he continues his outspoken support for religious liberty by engaging in diplomacy, research and teaching.

Throughout his nearly 35-year career in politics, Wolf worked tirelessly to advocate on behalf of victims of persecution and discrimination around the world and to make the promotion of human rights and religious freedom a greater priority in America's foreign policy. He authored the International Religious Freedom Act – legislation which created the International Religious Freedom Office at the State Department and established the U.S. Commission on Religious Freedom – and he chaired the Tom Lantos Human Rights Commission, a bipartisan group of U.S. Representatives charged

with promoting, defending and advocating for international human rights.

He continued to travel extensively in Africa, Asia and the Middle East, meeting with dissidents and members of religious minority groups. Around the world, he says, he encountered people who suffered because of their faith (or because of their lack of faith) and who felt that the international community was ignoring their plight.

"On a trip to Iraq I met with a group of Catholic nuns who asked me, 'Does the church in the West care about us?' On another trip in the 1990s we sneaked into Tibet and met Buddhists who couldn't understand why the West wasn't doing more to help them. They feel abandoned, and I believe we have a moral obligation to help."

To carry out that obligation, Wolf believes it is incumbent on people of faith to advocate strongly on behalf of religious freedom, not just for those who share the same faith, but for all people. To do that, he says, it is essential for researchers like those at Baylor and their RFP colleagues to document accurately the state of religious freedom in various places. With that information in hand, Wolf believes American diplomats can use their leverage to press for reforms.

"Ronald Reagan said that the words in the Constitution and the Declaration of Independence are a covenant with the entire world, not just those who were in Philadelphia in 1776. I believe that extends to the students who protested in Tiananmen Square and to the Yazidis currently being persecuted by ISIS. Religious freedom is important both domestically and internationally, and if we lose that freedom, we will have a very different society."



BRIC UPDATE

Now in its fourth year of operation, the Baylor Research and Innovation Collaborative is home to a growing number of robust research enterprises.

BAYLOR ACADEMIC DEPARTMENTS' GRADUATE RESEARCH

Baylor research faculty and graduate students from three academic departments

- Electrical Engineering
- Mechanical Engineering
- Computer Science

INTERDISCIPLINARY RESEARCH INSTITUTES AND CENTERS

- Center for Astrophysics, Space Physics and Engineering Research
- Center for Spatial Research
- Geophysical Fluid Dynamics Group
- Marlan Scully Quantum Optics Laboratory

2015 BRIC INFRASTRUCTURE EXPANSION

During 2015, an additional 10,353 square feet of space was constructed and completed for the following projects:

- Kuehl Geophysical Fluid Dynamics Lab: 2,741 square feet
- Rylander Gait Marker Lab: 1,528 square feet
- Rylander & Kuehl Offices on Level 1: 792 square feet
- Birkeland Current Engineering Lab and Office: 1,580 square feet
- Public Corridor Extension Outside Birkeland Current Suite: 1,557 square feet
- Public I Common Area Outside L-3 Suite: 2,155 square feet

RESEARCH PARTNERSHIPS

- The collaboration between Baylor mechanical and electrical engineering researchers and aerospace giant L-3, the first corporate BRIC partner, has produced a patented non-destructive inspection system for carbon fiber composite components and a highly effective prototype HDMI wireless airborne system.
- Baylor's partnership with Education Service Center Region 12 and architecture firm Huckabee, Inc., has produced its first sets of research data from surveys of teachers who participated in professional development workshops conducted in the 5,000 square-foot LEx Labs. Researchers from CASPER conducted the research study, which was funded by both Region 12 ESC and Huckabee.
- Six-year-old technology services and engineering company Birkeland Current continues to be an integral contributor to the composite materials non-destructive inspection project between Baylor and L-3. Birkeland is co-recipient with PRUF Energy Solutions of the 2015 Business Innovator Award from the Greater Waco Chamber of Commerce. The award recognizes the partnership for their jointly developed wireless, autonomous energy monitoring, tracking and control system.



A PLACE WHERE IDEAS COME TO GROW

- The BRIC quickly acquired a reputation as a go-to site for successful seminars, lectures, and other forums for the free exchange of ideas. Since its opening in 2013, the BRIC has played host to over 12,000 attendees at 600 academic, business and community events.
- Recent gatherings included a breakfast for BRIC community partners, technology business briefings sponsored by Chamber of Commerce officials and lectures by an active NASA astronaut and a noted mathematics educator.

