PUTTING SOME MUSCLE INTO RESEARCH
Multi-Method Approach to Biomechanics Research

DEVELOPING SENSITIVITY
German Classroom Sets Stage for Lessons in Diversity

TAKING FLIGHT
Professor and Students Create Bird Flight Simulator
The magazine has become a measure of research assessment and accountability. The challenge for the future is that our researchers will showcase increasing results in terms of quality, substance, and quantity. It is a challenge that I am sure our faculty will embrace with energy and enthusiasm and our constituency will welcome with pride.

I would like to take this opportunity to express my deep appreciation to Lisa Baldi, our Director of University Relations, and Nathan Moore, Assistant Director of Visual Communications, for doing such a fine job of maintaining this publication with such high standards. I also like to thank our Editorial Board for bringing ideas and being inclusive and collegiate in selecting the content of this magazine. Our college is a great place of learning where our research informs our teaching and our teaching informs our research thus creating a circle of excellence that ultimately benefits the success of our students.

RESEARCH at Penn State Berks

Volume 6 / Number 1 Winter 2013/2014

Editor
Lora R. Baldi
Art Director
Katherine A. Quinn
Copy Editor
Dr. Paul D. Esquela
Assistant Professor of Engineering
Penn State Berks

FIFTH ANNIVERSARY of Research at Penn State Berks Magazine

Five years ago, in the spring 2013, the following statement was included in the first issue of this magazine: “Penn State Berks has done an excellent job of reaching high standards of productivity when it comes to research and creative accomplishments, and the goal of this publication is to summarize some of our intellectual contributions.” That goal is very much alive today.

In these last five years (2007-2012), I am very pleased to report that we have published 357 refereed journal publications, 16 books, 41 chapters of books, and 50 creative works that include theatre plays and poetry. That is a total of 644 items generated by an average of 117 full-time faculty members, and more specifically, by an average of 73 full-time tenured and tenure-track faculty in the period from 2007-2012. It is an average of 1.26 items per year per faculty member with research duties.

The original goal of the magazine was to reach out to our community in Berks County to present our academic accomplishments. An additional goal was to share our work with the other 23 Penn State campuses. The magazine has been received with enthusiasm by all the constituencies that were originally targeted but most importantly, our own Penn State Berks community looks forward to the new issues to learn about our research accomplishments.

Research at Penn State Berks

By Lisa R. Baldi

I MAGINE THAT YOU ARE THE SOLE NOMINEE FOR a scholarship at a university comprised of approximately 75,000 undergraduate students, and that you actually receive the scholarship, which will fund your graduate studies. That is exactly what happened when Chris Brendel, a junior majoring in Communication Arts and Sciences at Penn State Berks, was nominated for and awarded the prestigious Beinecke Scholarship.

Brendel was selected as Penn State University’s sole student nominee for 2013 and he is the only second Penn State student to receive the award in the 22-year history of the Beinecke Scholarship. He is the first Penn State student to receive the award from a campus outside University Park.

Each year, approximately 100 colleges and universities are invited to nominate a student for a Beinecke Scholarship. Each school is permitted to make a single nomination each year. Twenty new scholarships were awarded in 2013.

“It’s an incredible feeling to know that I already have money for graduate school,” commented Brendel. “I am so thankful for this award and I feel truly honored to represent Penn State Berks and Penn State University as a whole. As a student at Penn State Berks, I know that simultaneously having the support of the Berks campus community and the resources of the University were fundamental to my receiving the award.”

Each scholar receives $4,000 immediately prior to entering graduate school and an additional $30,000 while attending graduate school. Brendel was nominated for the Beinecke Scholarship by Dr. Ruth Mendum, Director of the University Fellowship Office at Penn State Berks. Mendum chose Brendel from the pool of Penn State student candidates based on the rigorous criteria of the scholarship.

Brendel awarded prestigious Beinecke Scholarship

RESEARCH

By Lisa R. Baldi

Mendum cited Brendel’s combination of a high GPA, high level of commitment to research, and intention to pursue a Ph.D. in arts and humanities as a few of the factors that made his application rise to the top. He is also a Penn State Schreyer Scholar.

This summer, Brendel was awarded the highly competitive summer internship in the Research Training Program at the Smithsonian National Museum of Natural History. He worked with two curators at the Smithsonian to identify the influence that Spanish has had on an indigenous language called Juchitán Zapotec.

They also looked at changes in the phonology of the language.

“In addition, to his superior academic and commitment to research, Chris took extra coursework; he studied abroad in Leeds. It’s really the whole package: academics, commitment to research, extracurricular activities, and intention to pursue a graduate degree in the arts and humanities,” explained Mendum, who worked closely with Dr. Michele Kirsch, Associate Dean of Student Affairs at the Schreyer Honors College; as well as Dr. Sandy Feinstein, Honors Coordinator at Penn State Berks.

Mendum credits Feinstein for working with Brendel for a year before he applied for the Beinecke Scholarship, stating that it is important for students applying for these types of scholarships to develop a research plan, gain experience and to be courageous in the selection of a graduate course of study.

The most important thing for students who want to apply for these types of scholarships is to start early, get involved in supplemental and study abroad programs, and get involved in extracurricular activities.

The BEINECKE SCHOLARSHIP PROGRAM was established in 1971 by the Board of Directors of The Sperry and Hunchison Company to honor Ernest Edwards, founder of Computer History Museum. The program created an endowment to provide advisory scholarships for the graduate education of young men and women of exceptional promise. The program seeks to encourage and enable highly motivated students to pursue opportunities available to them and to be courageous in the selection of a graduate course of study in the arts, humanities, and social sciences.

RESEARCH at Penn State Berks

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Imagine taking a university course that places you in German schools where you don’t know the language, the curriculum, or the culture. That’s what Penn State Berks students majoring in Childhood and Early Adolescent Education have been doing for two weeks each May for the last two years in order to learn about developing sensitivity to diversity.

Dr. Jayne Leh, Assistant Professor of Special Education at Penn State Berks, has a passion for preparing teachers for diverse instructional settings. Her research centers around helping pre-service teachers understand how best to work with children with disabilities who will encounter in their future general education classrooms.

According to Leh, because of the U.S. model of inclusion, students with disabilities can be found in every classroom, but oftentimes education students are under the misconception that the chances are slim they will encounter a child with a disability. Because many teachers are ill-prepared to teach in the diverse U.S. classroom, and because many very young children may not even be identified in the early elementary classroom, teachers must be experienced and educated in terms of diverse populations and should be sensitive to individual differences—otherwise, they must be sensitive to diversity.

That’s where the international field experience comes in. Leh wanted to get pre-service teachers into settings where they would encounter something as completely different from what they were used to that it would force them to consider not only the differences they see, but also how to respond to and think and feel about those differences.

Two years ago, she created an opportunity for our pre-service teachers by designing a course that would take students outside the classroom to a venue that was completely different from anything they may have ever experienced before, to a setting where they wouldn’t understand the language and they would have to look to others for interpretation,” explains Leh.

“T wo years ago, I created an opportunity for our pre-service teachers because this would allow Penn State Berks students the opportunity to experience a diverse culture and feel what it might be like for a child with disabilities who is ‘different’ from everyone else, or a child who may be an English language learner. Our student teachers work with many children in the Reading School District for whom English isn’t their first language; because of this, the experience seemed invaluable and worth pursuing.”

For the last two years, Leh has been taking students to schools in Germany where German teachers give the instruction and the pre-service teachers experience the frustration of not understanding the language. This year, Penn State students will be delivering part of an English lesson to German children.

This helps the pre-service teachers to understand the role of culture in the classroom but it has to be well planned. Penn State students are encouraged to write, reflect, discuss, and debate frequently,” states Leh. “Everyone comes to the table with different views, background knowledge, and experience. Teachers have to be sensitive to all aspects of diversity in the classroom and they must be experienced and comfortable supporting children who may have problems with the English language, a cognitive deficit, or an emotional disorder, or children who may be culturally diverse.”

This was a life-changing experience for Alana Augello, a senior Childhood and Early Adolescent Education major. “I was able to make so many connections to classrooms back home and also view the classroom setting from a totally different international perspective. As I begin my career as a first-year teacher, I will take with me everything I learned and implement any teaching strategies I acquired into my future teaching career.”

Leh lived in Melun, Germany from 1988–1990, and got to know the German school system while her children were enrolled, so she had the connections to initiate this program. The first year of the program, Leh took the pre-service teachers to three schools in Germany: the Christian-Bitter School in Melun, an elementary school; The Hohland Landau School, a high school in Hanau; and the University of Freiburg. Due to time constraints and to maximize the time in the elementary setting, the group visited just the Christian-Bitter School and elementary schools in the vicinity of the University of Freiburg last year.

The goal of the course was for students to identify and consider the differences between the United States and Germany in terms of school settings (teachers, students, facilities, and curriculum), and the culture in general (school and non-school settings) while reflecting on their preconceptions. Penn State University had just signed a partnership agreement with the University of Freiburg, who put Leh in contact with the Freiburg University of Education, a teaching university.

Before going to Germany, Leh asked her students what they thought they would see in the German classrooms, and most students believed that the classrooms would be regimented and the teachers would be strict.

The reality was very different. “I expected the school to be completely structured with teachers acting as drill sergeants,” states Stacey Brandi, a senior majoring in Childhood and Early Adolescent Education. “It was completely different. Teachers didn’t stand in front of the room lecturing students; students were responsible for their learning with the assistance of teachers.”

According to Leh, the German curriculum stresses independence and a sense of responsibility from a very early age, and it is linked to the students’ ability to reflect on their own behavior—reflectivity.

As a result of her research, Leh has written a manuscript that was accepted for publication as a book chapter on reflectivity with two other professors at the college, John Giuseppi, Instructor in Economics, and Dr. David Bender, Associate Professor of Educational Psychology. The manuscript reports on the results of the international field experience, specifically the model of reflection that was used to promote change in the affective domain of the pre-service teachers who participated, the value of placing pre-service teachers in an international classroom setting, and the importance of identifying preconceptions as a way to facilitate reflection.

Currently Leh is working on establishing an exchange program between Penn State Berks and the Freiburg University of Education in which Penn State Berks pre-service teachers will shadow German pre-service teachers, and German pre-service teachers will come to Penn State Berks and do the same. Faculty may also participate in the program and teach at the partner university. In addition, an exchange program is in the works for the education students of both Penn State Berks and Freiburg University of Education.

Last year, Germany was mandated to bring inclusion to its classrooms. Until recently, German schools placed children with disabilities in separate classrooms. So while Berks students are learning from the German curriculum, German students will learn about inclusion—Leh’s area of research—from Penn State Berks students.
The Silent Screams of Abuse

By Dr. Brenda L. Russell, Associate Professor of Psychology

When you read this testimonial, what did you picture in your mind? Were you able to imagine the victim? Could you picture the abuser? Did your brain double-back a little when realizing that the victim in this case was the husband? This is a quote from a victim of domestic violence. When we hear such testimonials, we recoil in anguish and wonder why they continue to stay with their abuser. Did you imagine the victim as a female and the abuser as a male? If so, you represent the majority. It is not surprising that one would imagine this testimonial to be from a female victim of abuse. According to the Department of Justice, 1.3 million women are physically assaulted by their partners annually. What most people don’t realize is that the same report found close to a million men are also victims of physical abuse by a partner, and rates for those in same-sex relationships are similar to those of heterosexual couples. Thanks to the feminist movement, the evolution of the battered woman’s movement has made substantial strides over time. Public awareness has increased and resources have been allocated to help female victims. Our awareness has increased to the point that most of us believe that testimonial must be from female victims of abuse.

Even the term “the battered woman’s syndrome,” first coined in the 1970s by Lenore Walker, connotes a female victim. It also suggests that females who experience abuse will often experience symptomology as a consequence of abuse. While the syndrome and its use are highly debated among scholars, it has created a standard to which all victims of abuse are compared. In essence, we have created a stereotype of a victim of battering, and she is a female, meek, passive, withdrawn, controlled, pathological, and helpless.

Let’s take the case of Jodi Arias who was recently convicted of first-degree murder of her ex-boyfriend, Travis Alexander, on May 8, 2008. Arias claimed she was defending herself from her abusive ex. However, she didn’t quite meet the stereotype of a battered woman. Arias was anything but passive; she dated other people, was outgoing, and did not display the symptoms of a typical battered woman. Arias used a claim of self-defense to mitigate the death penalty. In contrast, Barbara Sheehan from Queensland, New York, used self-defense to explain why she shot her retired police sergeant husband eleven times with two different guns. Sheehan was acquitted of that offense. The difference was that Sheehan fit the typology of a battered woman.

My research examines how gender and sexual orientation of the defendant in cases of domestic violence where the defendant kills their partner and claims self-defense, crimes of duress, and crimes of passion influence legal decision making. I have found violence directed toward heterosexual females is perceived as more serious than the same crime committed against a gay male, gay female, or heterosexual male. Results also suggest assaults among gays are often perceived as less serious because the victim and assailant are considered the same sex. My research studies have found heterosexual female defendants who kill their partner in self-defense, crimes of passion, or commit crimes under duress receive the lowest ratings of guilt and sentencing while heterosexual males and female homosexuals receive the highest ratings. So why is this important?

Legal professionals, law enforcement officers, and laypersons need to recognize the potential for bias and use this information to provide a social framework from which to assist their clients and understand their own judgments. Research can be used to facilitate gender neutral training for law enforcement, but we all can learn to teach our children about how gender stereotypes influence behavior. Abuse is abuse, and should not be tolerated more for some than others. It is vital that all of us address our own bias of what it means and who is a victim of abuse. While it is not my purpose to minimize the victimization of women, I do hope to bring attention to all victims of intimate partner violence. As the upholders of a justice system and protectors of the law, we need to recognize the potential for bias, and we must not only understand the potential for bias, but we must also recognize the potential for bias and use this information to provide a social framework from which to assist our clients and understand our own judgments.

“Men may be reluctant to report for fear of the stigma of being a male victim and not conforming to the masculine stereotype. Heterosexual men also fear they will be perceived as the primary aggressor and subsequently arrested. “Men may be reluctant to report for fear of the stigma of being a male victim and not conforming to the masculine stereotype. Heterosexual men also fear they will be perceived as the primary aggressor and subsequently arrested.”

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**Print Material**

**Building the Future through 3-D Printing**

By Walter F. Fullam, Director of Continuing Education and Outreach

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The *arithmetic* of manufacturing is changing. In the future, manufacturers will rely less on subtraction and more on addition to create products. Manufacturing is the process of transforming raw materials into finished goods. To accomplish this process, manufacturers use a variety of techniques such as casting, machining, molding, and grinding to create finished goods. In these types of processes, a product is made by subtracting material.

While these traditional forms of manufacturing will never be eliminated, a new manufacturing process, called additive manufacturing or 3-D printing, is taking hold and it promises to revolutionize the way many products are made.

Additive manufacturing or 3-D printing is the process of creating a three-dimensional solid object from a digital model. It is achieved using an additive process, where successive layers of material are laid down in different shapes. Additive manufacturing is being used in industries from automotive to aerospace to fashion to construction.

The process is even being explored in the biotechnology arena as a means to reproduce human organs.

In reality, the additive manufacturing revolution has only just begun, and many companies and industries are attempting to determine how best to take advantage of this new manufacturing method. As a result, the federal government has created the National Additive Manufacturing Innovation Institute (NAMII) as a resource to help spread the adoption of this new approach. Penn State is one of the lead educational institutions involved with NAMII along with the University of Pittsburgh, Carnegie Mellon University, and the University of Connecticut.

A number of Berks County companies have adopted additive manufacturing including Grosfillex in Robesonia and EnertSys in Bern Township. Grosfillex is an international company that manufactures a wide range of resin-based products such as outdoor furniture, and EnertSys is leading global supplier of industrial batteries. Both companies primarily use additive manufacturing for the rapid prototyping of new products.

Penn State Berks has begun introducing students to additive manufacturing. The college has a small 3-D printer, which students in the Introduction to Engineering courses taught by Elizabeth Wiggins-Lopez, Instructor in Engineering, use to create non-structural 3-D models. Both companies primarily use additive manufacturing for the rapid prototyping of new products.

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Photos by Theo Anderson
Youthful Energy

FITT Youth Combats Obesity

By Helen A. Hartman, Senior Lecturer in Kinesiology, and Lisa R. Baldi

The Sounds of Laughter and Children
at play can be heard coming from the Conference Center Wing of the Reading Hospital once a week. These children are participating in FITT Youth—Fun, active, healThy, youTh, a joint program of the Reading Health System, Penn State Berks, and Penn State Berks Cooperative Extension.

FITT Youth is a coordinated effort for children who have been referred by their pediatricians as being at-risk for childhood obesity. The program integrates physical activity, nutrition, and education for parents and caregivers. It is free to participants, and each component is vital in helping curb the obesity epidemic.

Each session begins with one hour of fun physical activity, led by Helen Hartman, Senior Lecturer in Kinesiology at Penn State Berks, and Penn State Berks students majoring in Kinesiology. The children then learn about nutrition from Reading Hospital Clinical Dietitian Christine Bacher. While the children are engaged in physical activity, the parents learn how to shop and prepare nutritious meals for the family, and they also prepare a healthy snack for the children along with Iliana Almodovar, Penn State Nutrition Links and Education Adviser with Penn State Extension Berks County. Each component of the program is coordinated by Colleen Sauls, Family Advocate for the Children’s Health Center of the Reading Hospital.

FITT Youth is held once a week for eight weeks during the fall and spring semesters. Each semester targets a different group of students: one semester will target grades 2-5 and the next semester will target grades 6-8.

“My philosophy is the more we move, the better we are at moving, the more successful we are at moving, the more we will want to move.”

When asked why the program is aimed at changing the behavior of young children, Hartman explains, “We found that the older youth were already set in their habits and that the parents really struggled with change. Sometimes by the time the children reached a certain point, the parents or guardians had given up on trying to make a change.”

So how do they motivate the children to participate and make physical activity fun? Each child gets a pedometer to wear during the weekly session. Then they engage in a simple activity with the Kinesiology students. It doesn’t take long for the children to find a ‘Kines buddy’ who they work with each week. According to Hartman, often these children do not have an adult mentor in their life, and it’s wonderful to watch the bonding and trust that develops and grows each week.

The warm up consists of about ten stations involving some type of motor skill—hand-eye coordination, balance, agility, symmetrical or asymmetrical movements. Their buddy records the number of successful attempts. It doesn’t take long for the children to become adept at the different stations. When that occurs, they are challenged to switch from using the dominant hand to the non-dominant hand or using alternate hands to keep it interesting.

Hartman states, “My philosophy is the more we move, the better we are at moving, the more successful we are at moving, the more we will want to move. The more we move in different environments or settings, the more confident we will be throughout childhood and adulthood in taking that first step of physical activity.”

Next the children are taken through their FITT Yoga routine. The purpose of FITT Yoga is for the children to follow along with audio and visual cues. They practice fun, zany movements involving changing direction and balance, and the parents/guardians are asked to participate as they can interact with the children at home during the week.

The children also work on eye-hand coordination using a myachi (small bean bag similar to a hacky sack in which players use hands rather than feet). The movements involve individual and partner activities. The children work individually with their buddy and sometimes as a team on skills such as cooperation, strategy, and leadership. These activities may include flag tag, builders and bulldozers, musical spots, or themed events like egg-stravaganza, monster relays, egg hunts, and scavenger hunts. In nice weather, they take a walk to the Reading Public Museum for Frisbee golf and everyone’s favorite game—ultimate chicken, which is ultimate Frisbee with a rubber chicken instead of the Frisbee.

As the Kinesiology students take the children through their stretches, Hartman collects the pedometers and records their steps for the hour—1,855, 2,304, and even 3,336. Their steps for the hour—1,855, 2,304, and even 3,336. The children are always interested in knowing their number of steps and if they improved from the previous week. They have learned many new skills in the session—most importantly, that physical activity is a daily requirement to living a healthy lifestyle.
Putting Some Muscle into Research

Multi-Method Approach to Biomechanics Research

By Dr. Ben W. Infantolino, Assistant Professor of Kinesiology

Biomechanics is the study of biological systems using the principles of mechanics. Since muscle is responsible for producing human motion, it is a very relevant topic of study in Biomechanics. Computer models of muscle are critical to our understanding of muscle function and have been purported to be used to direct surgeries that are designed to improve movement for individuals with a movement disorder. My research focuses on how whole muscle produces force and how variability in muscle can affect the computer model results.

In my research, I use a variety of methods to examine muscle force production capabilities. I use cadaveric specimens, magnetic resonance imaging (MRI), and ultrasound, as well as live subject protocols to investigate muscle. By using a variety of methods, I can overcome the shortcomings of one method by another.

Cadaveric specimens offer unrestricted access to muscle tissue. Anything (‘braids force’) that is of interest in terms of muscle function can be measured on cadaveric muscle tissue. Much of my research has used cadavers to measure basic parameters of muscle (mass, length, angulation). These basic parameters are critical inputs to muscle models.

In many cases, current muscle models combine parameters from different previous studies for the inputs of the muscle model. My research has focused on highlighting the variability that exists between cadavers (and by extension live subjects) for the critical parameters necessary for the construction of a muscle model. I have shown that variability has a large effect on muscle model output. Two areas that cadaver dissection is limited in is the ability to produce force like a live subject, and the stability to easily visualize the three-dimensional architecture of the components that make up a muscle.

Whole muscle is comprised of fascicles which are bundles of muscle cells. How these fascicles are arranged in a muscle determines the range of motion and force production capabilities of muscle. Since these fascicles exist in three dimensions, traditional dissection cannot be used to determine the arrangement of the fascicles throughout the whole muscle volume.

High-field Magnetic Resonance Imaging (14 tesla) MRI can be used to take cross-sectional images, which are then used to reconstruct fascicle arrangement in three dimensions. Fascicles that are arranged in series will produce a muscle that has a large range of motion and can shorten quickly while fascicles that are arranged in parallel produce a muscle with high force production capabilities.

My research has shown even small muscles have serially arranged fascicles that wrap around a central tendon. The exact function of the fascicle wrapping is unknown. Using high field MRI to view muscle poses two problems: the bore size of the MRI is too small for a live subject to place a limb into the machine, and the scan time is too long (~14 hours) for a subject to remain still in the machine.

Ultrasound is a real-time imaging system that allows for the production of a cross-sectional image of muscle on a live subject while they are moving. These real-time videos or images can be used to measure many of the basic parameters of muscle including muscle volume and fascicle angulation. Ultrasound can be combined with machines that can measure the force exerted by a limb and the limb’s position in space, which allows for the determination of even more parameters of muscle function.

In my research, I have fully characterized the First Dorsal Interosseous muscle noninvasively in live subjects. Unfortunately, to fully characterize a single muscle you need a mathematically determinate system, which is rare in the human body with many muscles crossing a single joint. The solution to this problem is to use cadaveric data to aid in splitting up the contribution of each individual muscle.

Whole muscle is comprised of fascicles which are bundles of muscle cells. How these fascicles are arranged in a muscle determines the range of motion and force production capabilities of muscle. Since these fascicles exist in three dimensions, traditional dissection cannot be used to determine the arrangement of the fascicles throughout the whole muscle volume.

High-field Magnetic Resonance Imaging (14 tesla) MRI can be used to take cross-sectional images, which are then used to reconstruct fascicle arrangement in three dimensions. Fascicles that are arranged in series will produce a muscle that has a large range of motion and can shorten quickly while fascicles that are arranged in parallel produce a muscle with high force production capabilities.

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"Involvement in undergraduate research provides a strong research foundation for many of our students who continue on to Doctorate of Physical Therapy or other graduate programs.”

I have initiated a healthy undergraduate research program at Penn State Berks. Students who are in Science Emphasis of the Kinesiology program at Berks are required to complete a thesis their senior year. This past year, five students produced publication-level work relating to my research program with one manuscript currently in review.

Students are now starting to work with me on my research projects earlier than their senior year to gain additional experience before their senior research project. Involvement in undergraduate research provides a strong research foundation for many of our students who continue on to Doctorate of Physical Therapy or other graduate programs.

Muscle is an exciting area of research because it is a challenging tissue to study. Using many different research methods helps elucidate more about muscle than one single approach can. This multi-method approach also allows for many students to be involved in my research, and produces a research plan where one area supports another.

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Fracking Calculations
Professor and Student Team Up To Investigate Environmental Effects of Fracking

By Kristin M. Boyd, Freelance Writer

Dr. Lorena Tribe uploads a set of atoms, their sizes, and coordinates into a computer visualization program called Molden. Seconds after she presses the “enter” key, a 3-D diagram of molecules that visualize her calculations pops up on the bright orange screen. She jots down a note, adding another layer to her research of how arsenic interacts with soil and how it can be remediated. She repeats the process with a new set of data. Another picture pops up. This can go on for hours, she says.

“Some days, you keep going, trying new calculations. You might think you know what will happen, but you get surprises and then you want to try something else,” explains Tribe, Associate Professor of Chemistry at Penn State Berks. “It’s my work, but it is fun for me to watch the program take those numbers and turn them into a movie.”

In addition to researching arsenic, she has been utilizing computational chemistry, a scientific area that uses computer technology and quantum mechanics-based software to better understand how the fundamental properties of atoms determine their reactions when they get close to other atoms. The process, she says, allows researchers to predict accurate results in complex systems.

In addition to researching arsenic, she has been utilizing computational chemistry to study hydraulic fracturing, specifically how the fluid used in the fracking process may interact with rocks and affect water supplies. It’s a joint undergraduate project with her former student, Michael Kilmer, who’s now a junior Environmental Systems Engineering major at Penn State University Park campus.

“The fusion of technology and chemistry is wonderful,” Tribe states. “It allows you to break down complex experiments and assist in making an interpretation by visualizing at the atomic level. For science, this is an exciting time to be in. Computational chemistry can help solve real problems.”

Tribe and Kilmer say they bonded over their shared love of chemistry and the environment.

“Dr. Tribe showed me her projects and how she used molecular modeling to determine whether certain chemicals stuck to various surfaces,” Kilmer says. “The techniques she was using for her work—I knew I could apply them to problems or questions of interest related to fracking and the natural gas industry.”

Kilmer recalls watching water trucks rambling up and down the roads surrounding his hometown of Nicholson, Pennsylvania, which is within the Marcellus Shale region, an area that contains approximately 410 trillion cubic feet of shale gas, according to the U.S. Energy Information Administration. While he’s seen the economic impact of fracking, he’s also curious about the environmental impact of the chemicals being pumped into the ground during the fracking process.

“It’s my goal to try to protect the environment,” he explains. “I didn’t know too much about fracking, but one of the wells that eventually went in was near my house. There were a couple of board meetings about it at the community meeting hall, and that sparked my interest in the natural gas industry and doing research about it.”

Though Tribe knew little about fracking industry when she initially met Kilmer during his first year at Penn State Berks, she has been intrigued by her surroundings—both physical and natural—since her childhood in Argentina. She remembers eagerly listening to discussions about climate change, acid rain, and the ozone layer when she was an undergraduate student at the University of Buenos Aires.

“I saw these topics early in my career, and while they dealt with the environment, they were essentially chemistry problems,” she states. “I find it very exciting that my understanding of atoms and their interactions can help shed light on these global problems.”

In spring 2012, Tribe and Kilmer teamed up and began researching fracking fluid, its components, its impact, and possible alternatives. It proved difficult initially, they explain, as there seemed to be less available scientific literature than for other topics.

Tribe and Kilmer began by conducting extensive online searches, where they found a list of the thirty-plus contaminants, most used in fracking fluid. “Some contaminants are natural and probably not a problem like natural salts or carbonates,” Tribe clarifies. “But if one is a health hazard, and they’re pumping it into the ground, the question is: ‘What’s going to happen once it’s there?’”

Tribe and Kilmer decided to focus on one contaminant—acetaldehyde, used to prevent corrosion of the pipeline. They used the computational chemistry program Gaussian 09 to determine if that specific chemical would stick to underground clay minerals or if it would be able to flow back to the surface. In this “vacuum situation,” as Kilmer describes the preliminary calculations, they learned the contamination did not stick.

Kilmer, who is now beginning to study alternatives for fracking fluid, has presented their research at several local and national conferences. He and Tribe are also planning to publish the results in a peer-reviewed journal, he says.

Back in her office, Tribe says she’s excited that computational chemistry is bringing science to life and providing real-world research examples for many students like Kilmer. She is very proud of the achievements of her research students.

“I keep current with the advances in computational chemistry, and I allow my students a lot of leeway in terms of coming up with topics to explore,” she says. “I have done some interesting research in materials, and in medicinal and environmental chemistry, largely because of undergraduate projects. I’m always trying to engage my students and match their areas of interest with my expertise.”

What is Hydraulic Fracturing?

Hydraulic fracturing, commonly known as fracking, is the process of extracting natural gas from shale rock layers deep within the earth.

In Pennsylvania, the Marcellus Shale lies under the Appalachian Basin, and it spreads across to surrounding states, including New York, Ohio, West Virginia, Maryland, Tennessee, Virginia, and Kentucky.

Fracking occurs when water mixed with other components is pumped into the ground to create cracks, also called fissures or fractures, to release the natural gas into specialized wells that have been built for its collection.

Today, as fracking continues to be hotly debated, scientific researchers are increasingly studying the fracking process and its impact, and lawmakers are working to establish stricter regulations for the fracking industry.

Source: fracfocus.org; eia.gov
Deciphering Zodiac Killer 

Motivation

Course Seeks To Identify Zodiac Killer

By Lisa R. Baldi

Dr. Michael R. Bartolacci, Associate Professor of Information Sciences and Technology at Penn State Berks, was looking for a fresh, new idea for the Senior Capstone course that included both Information Science and Technology (IST) and Security and Risk Analysis (SRA) majors.

Then he came across an article about the infamous Zodiac Killer, which stated that in certain jurisdictions, it is still considered an open case. (It is classified as a cold case in San Francisco.)

According to trutv.com, “Even though police investigated over 2,500 potential suspects, the case was never officially solved. There were a few suspects that stood out, but the forensic technology of the times was not advanced enough to nail any one of them conclusively. This October 1966 killing began a ghoulish series of murders that panicked the people of the San Francisco area. For years the Zodiac taunted the police with weird ciphers, phone calls, insulting and cryptic messages. Before it was all over, this clever and diabolical killer claimed the lives of eight people, only two of whom lived to tell the tale.”

Bartolacci thought that the decryption of handwritten notes in the current era of digital communication would make an interesting capstone project.

“The goal is to develop a system to digitize handwritten messages with the objective of decrypting the notes from the Zodiac Killer. There are several different parts to the problem: taking the handwriting and getting it into digital form, being able to parse each individual item, and then applying decryption algorithms.”

Currently Bartolacci’s research focuses on an information security attack, which he identified as posing a growing threat. The idea is that a Personal Denial of Service (PDOS) attack. A traditional Denial of Service (DOS) attack is one in which computers are set up remotely with malicious code to attack other computers (usually web servers) and overwhelm them with “garbage traffic.” Bartolacci thinks that the decryption of handwritten notes in the current era of digital communication would make an interesting capstone project.

“It’s the perfect crime,” states Bartolacci. “Very easy to perpetrate, very difficult to track, and it may not be illegal depending upon your jurisdiction.”

Bartolacci is collaborating with a professor at Dakota State University and one at Vanderbilt University on the analysis of a survey they created to determine what motivates individuals who perpetuate a PDOS attack and how widespread such attacks are in the computer-savvy “gamer” generation. Their theory is that gamers don’t see PDOS attacks as a crime, but as just another aspect of online life.

In addition to developing interesting class projects for his students and his research on PDOS attacks, Bartolacci also conducts research in wireless telecommunications, most recently focusing on the best locations for portable mobile towers that are deployed in the event of a disaster. Other areas of research include telecommunications modeling, electronic commerce modeling, customer relationship management, manufacturing modeling, and international aspects of telecommunications.

The project began when Bartolacci was chatting online with Dr. Rita Higa, medical forensic doctor and Professor of Toxicology at University of West São Paulo, who posed a question to the online community: If police find human remains (particularly a skull) and have a photo of a missing person, is there a cost effective way to determine if the remains belong to the missing person using readily available hardware and software?

Bartolacci decided to turn the question into a student-based research project, which he assigned to two IST classes that he was teaching. The success of this project was the impetus for the Zodiac Killer slant to the current class project.
IT IS SPRING, AND YOU ARE SITTING BY YOUR window watching the birds pecking away at worms and seeds on the ground, and then suddenly they perform a squat-like motion, pull their wings out, flap hard, and fly away. Even raptors and other bigger, heavier birds do this with so much ease. They do not need a long runway nor do they need to run, accelerate, or gain high speed to take off. Watch the same birds land and that is an amazing feat too. They can land on an electric wire up in the air and never crash. Somehow in aping the flight of nature, we humans missed something.

The success of the Wright Brothers with their fixed wings brought an early demise to flapping flight. Not many know, but Otto Lilienthal had some preliminary success with flapping flight after studying the subject extensively. It is said that the Wright brothers and Lilienthal had exchanged several notes on flying machines.

In recent years, there has been a great interest in flapping flight, but most of it is focused on the smaller end of the scale, namely insects and other tiny flying creatures. The flights of these creatures are characterized by thin membrane wings that flap at a very high frequency.

My research with undergraduate students in the Mechatronics and Intelligent Systems (MeIS) lab at Penn State Berks focuses specifically on birds and more closely on how they generate lift and thrust from the flapping motion of their non-membrane wings. The research is not looking at gliding flight as seen in soaring raptors and other larger birds that use thermal eddies to soar, but at flapping flight at lower altitudes with a several types of disturbances such as wind gusts.

We need to overcome weight due to gravity by an opposing force called “Lift.” To move forward we need “Thrust.” Whenever there is thrust we have the necessary and evil force of “Drag.” The idea behind flight is to generate enough lift to overcome weight including any payload and focus the rest of the energy in generating thrust to move forward and maneuver in the air.

In our pursuit of the bio-mimicry of birds, we are working towards reducing the weight, while emulating the bird as closely as possible in the wing motion. You might notice that a bird’s flap is slower and takes longer on its path from the top to the bottom. Then on the return path, the wing is folded and goes to the top ready for the next flap in a quicker time.

The key focus of my research begins with the development of a quick return mechanism emulating the bird closely. In the mechanism, the flapping down motion, which generates lift, takes a longer time and the flapping up motion, which reduces the lift, is completed in a shorter time. The mechanism also replicates the wing fold on the motion of the wing to the top.

The group is experimenting with other types of quick return mechanisms. We have developed wings that replicate bird wing motion but with two joints rather than the three joints that are in an actual bird. Typically these joints would be powered by motors and would need batteries, which in turn would increase the weight. After several iterations, we have developed a wing which holds flat during the flap down and folds when flapping up. This was achieved by a custom developed passive mechanism with springs.

Based on the simulations, membrane wings were built and tested. It has been our groups’ belief that wind tunnels are excellent tools to study fixed wing flights, but are poor tools for studying flapping wing flight due to the disturbances caused to the air flow due to the moving wing. To overcome this, the MeIS team is developing an alternate test bed that is not wind tunnel based.

Our immediate goal is to be able to obtain a mathematical model for the flapping flight that can be used for the control of the flying bird we will build. The next step is to make the bird fly autonomously.

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**Taking Flight**

Professor and Students Create Bird Flight Simulator

By Rungun Nathan, Associate Professor of Engineering
On His Turf

Company Establishes New Endowment in Honor of Professor

By David C. DeLozier, Director of Development and Alumni Relations

Fidanza has been a faculty member at Penn State Berks since 2000, achieving the rank of full professor in 2011. In his position, he works closely with the green industry and other agricultural commodity organizations to support the college’s teaching and research programs. He is active in numerous professional and trade organizations.

“I am honored to know the many wonderful people in this organization,” states Fidanza. “The collaboration and support of our industry partners like Turf Equipment and Supply Company make it possible to fulfill Penn State’s land-grant mission of teaching, research, and outreach. This scholarship is a reflection of the company’s commitment to educating tomorrow’s leaders in the green industry. Our young people, just starting their career and getting into this industry, can look at this organization as one that has done it the right way.”

Establishing this endowment will ensure ongoing support for the Penn State Berks turfgrass program for many years to come.

Grants Make Research a Reality

By Marga H. Row

In the last few decades, research grants at Penn State Berks have increased exponentially.

A total of twelve proposals were submitted between July 1, 2012 and June 30, 2013, requesting a total of $1,213,129. Of the twelve proposals submitted, eleven are pending. Penn State Berks received four awards in fiscal year 2012/13. These awards include:

**Dr. Robert Forrey, The National Science Foundation awarded Dr. Robert Forrey, Professor of Physics, a $230,695 grant for his project titled “RUI: Quantum Mechanical Studies of Hydrogen and Helium: Applications in Astrophysical, Ultracold, and Industrial Environments.” Forrey will conduct theoretical research using full-dimensional quantum mechanics to calculate fundamental properties of atomic and molecular systems that contain hydrogen and helium. The astrophysical studies will include the origin of molecular hydrogen and its critical role in the formation of the first generation of stars in the universe. The ultracold studies will include the formation and dynamics of van der Waals molecules in magnetic traps at temperatures near absolute zero. The industrial studies will include chemical reactions on the surfaces of metallic clusters, which are relevant to heterogeneous catalysis, hydrogen storage, and fuel cell development for existing a hydrogen economy. The grant is effective from September 1, 2012 through August 31, 2015.**

**Dr. Leonard Gamberg, The U.S. Department of Energy awarded Dr. Leonard Gamberg, Associate Professor of Physics, a $128,000 grant for his research project titled “Transverse Spin and Momentum Structure of Hadrons in QCD.” Gamberg’s research in subatomic particle physics focuses on the role basic elementary particles play in the fundamental understanding of the internal structure of the nucleus and other hadrons. Using quantum chromodynamics (QCD), he explores the underlying symmetries of the theory to characterize the nuclear interaction of quark and gluons. A major goal of the research is to map out the transverse spin and momentum substructure of the nucleon in terms of its constituents, and shed light on how these quark and gluon degrees of freedom bind together to form the proton and neutron. His theoretical work is closely tied to experiments carried out at laboratories such as the Thomas Jefferson National Accelerator Facility in Newport News, VA. The grant is effective November 15, 2013 through November 14, 2015.**

**Dr. Janelle Larson, Division Head of Engineering, Business, and Computing and Associate Professor of Agricultural Economics, has been awarded $11,371 for a project titled “Sustainable Technologies for Orange and Purple Sweet Potatoes (STOPS) in Ghana” through a grant the Penn State College of Agricultural Science received from Tuskegee University. The grant is part of a USDA project. This project seeks to identify bottlenecks in the value chain (production, processing, distribution, and consumption) and develop a means to address these constraints. Larson’s role in this project will be value chain analysis. Project findings will inform the development of technologies and institutional innovations to enhance sustainable, nutritional health of women and children, and equitable food security. This grant is effective from June 1, 2013 through May 31, 2014.**

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Research endowments for the future

Few institutions have integrated education, public service, and world-class research as successfully as Penn State. At Penn State Berks, our students thrive in an atmosphere of intellectual discovery, and many of our students choose to complete their baccalaureate degrees at our campus because of the opportunities they have to partner in research with top faculty members.

Endowments have the potential to yield tangible benefits for many years to come because the gifts are held by the University in perpetuity. At Penn State Berks, we would welcome the opportunity for additional ongoing research funding, particularly for faculty-student research partnerships. Funding that enables our students to participate in these kinds of research opportunities will help them to become the people making life-changing discoveries both now and for the future.

For more information on how to establish a research endowment at Penn State Berks, contact the Office of Development at 610-396-6056.