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Memorial Union Renovation p. 12

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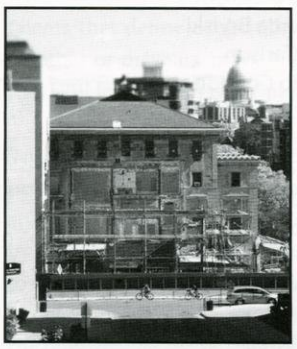

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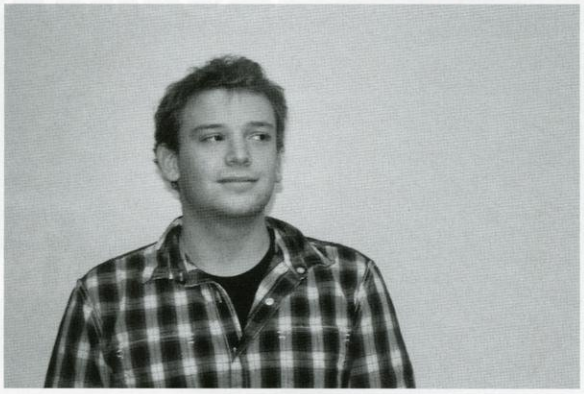
Relationship Advice



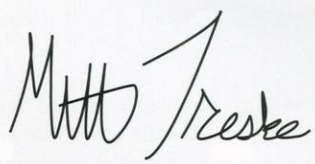
Editorial by Matthew Treske

One of the most important lessons I've learned in my time at UW-Madison came neither out of the classroom nor from the daunting collection of textbooks on my bookshelf. After what I will conservatively label as a tumultuous tenure in the College of Engineering, I am now only beginning to realize the value of the relationships we have with our friends, families, advisors and acquaintances. While perhaps a trivial sounding statement on the surface, the unique personalities and talents that define us as individuals can act both as agents that bind us together or drive us apart. No class can adequately prepare one for what they will learn about other people in college.

We are told that our years in college are the best times to branch out into new experiences and to try new things in the interest of self-discovery and growth. Most of us find that the best way to learn is by doing, but by doing something new, you leave yourself vulnerable and susceptible to failure. For some, the fear of failure is a perpetual spectre that stands between us and our ambitions. However, it is only by allowing ourselves the opportunity to fail that we can truly learn something meaningful.

How and with whom we choose to interact can be just as influential on our performance in the classroom as our dedication to Wendt library. We rely upon other people to bring out the best in ourselves. It was tough for me to wrap my head around the idea that there were others that were invested in my success as a student here. It takes a certain amount of courage to be able to let your guard down and find out who those people are; you will also find out who those people are not.

The lesson I learned is that people will surprise you. It is impossible to predict how two people can benefit each other until they try. You will never really know where you stand with someone until you ask. Leave no stone unturned because some of the most meaningful relationships you will develop could be born of the most unlikely of circumstances.



Editorial by Austin Kaiser

December graduation is soon approaching and my biggest fear about diving into the 'real world' is not knowing who I will make friends with when I move to a new city to start my career. I have had many best friends through the years: the boy I've known since preschool, my high school tennis partner, my freshman year roommate, the guy I met in the library studying for a calculus exam, a friend from high school who turned into a roommate in college and the guy from a semester long group project that ended up being more than just a friend. It's not that the people who have fallen in and out of my life in the past few years have changed that quickly, but the time and effort that I have put into these relationships has.

Every relationship has its ups and downs; the manner in which you handle the hard times usually determines how close you are to a person or how much work you are willing to put in to keep them in your life. You may have a bad experience with someone that makes you realize that you are a better person without them, or you may realize that you really do need them in your life. Sometimes it only takes one small fight to determine who your true friends are; the people who stand by you when you're at your best are not always there for you when you're at your worst.

Often the biggest determining factor in any relationship is time. It can be very easy to get along with someone when you first meet them, but it is what you learn about people after time has passed that will either make you want to keep them in your life or not. What I have learned about relationships is to work for the ones that mean something to you and to not stress over people that won't be there to pick you up when you fall.

It will be hard moving to a new city and not having any relationships that have had time to develop, but hopefully the relationships I have worked so hard to keep over the past few years will continue to get stronger.

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the Wisconsin Science Festival

The second annual Wisconsin Science Festival was a major hit in Madison and across the rest of the state. With over 150 events for all ages, curious minds across the state were fed a three course meal of the sciences, arts and music.

The joyous shouts and screams from kids of all ages could be heard across campus on the last weekend of September; the noise coming from the excited youth expanding their scientific knowledge through one of the many events being held at the second annual Wisconsin Science Festival. Events were held all over the city of Madison and several more throughout the state Thursday through Sunday, filling places like the Wisconsin Institute of Discovery (WID) to the brim with curious minds. The events were hosted by many UW systems groups as well as local, private organizations, each providing a unique topic in which to learn about.

Kids and adults alike were enlightened using every sense of the body

Kids and adults alike were enlightened using every sense of the body; hearing the sounds of Sound Ensemble Wisconsin, seeing microscopic plant cells, tasting the chocolate from the Bean to Bar stand, smelling the grains and hops used to make beer and even handling a dissected brain. With over 150 presentations, exhibits, hands-on stations, workshops, films and performances taking place across Madison and the rest of the state, there was no shortage of new knowledge to be had for a curious Wisconsinite.

The festival explored all facets of life; from nano to macro, past to future and beyond the stars. The arts got attention as well, providing kids with an arts and crafts station, an art installation featuring works utilizing the Fibonacci sequence and a presentation by Richard Davidson and Ben Sidran discussing "Neuroscience, Jazz and the Science and Art of Recovery", which was fittingly preceded by UW-Madison Chancellor David Ward officially launching the university into its Year of Innovation.

According to Julie Underwood, Dean of UW-Madison's School of Education and co-chair of the event, the festival was, "A huge success, there was something for everyone" and when opening up the door to the WID, "the sound alone could almost blow you over," a sign of the events popularity. She explained that the event was a hit for kids of all ages, gave K-12 grade teachers ideas for new teaching methods and sparked the interest of those fascinated with the arts, music, science or entrepreneurial ventures.

In her second year as co-chair for the festival, Dean Underwood helped pull together support for the event across Madison and the rest of the state; including events in Sheboygan, Eau Claire, Milwaukee and La Crosse, to name a few. Participation did not exclusively include university sponsored programs; several Children's Museums across the state, the Wisconsin Alumni Research Foundation, and local tech, arts and sports organizations contributed to the success of the event.

Laura Heisler, festival director, was also an integral factor to the overall success, starting the planning process for the event just weeks after last year's debut. She played a major role in recruiting sponsors

for the event as well as conducting fundraising to support the cause. As director she also thought the event was a "huge success" that "exceeded expectations in terms of numbers."

The committee is already "unofficially looking ahead to next year," says Heisler, while Dean Underwood looks forward to "expand[ing] the breadth of material covered by the events at the festival even further" and "hopes to see the [festival] all over the state." After only its second year, the future looks bright for the festival. The event has been established as an attractive experience for children and teachers all over the state, but Heisler wants to expand upon the current success and make the event as "inclusive as possible. Everyone gets that it's a family friendly event, [but the] twenty-something crowd is always hard to get." Both Heisler and Dean Underwood anticipate more events and advertising to attract this difficult demographic.

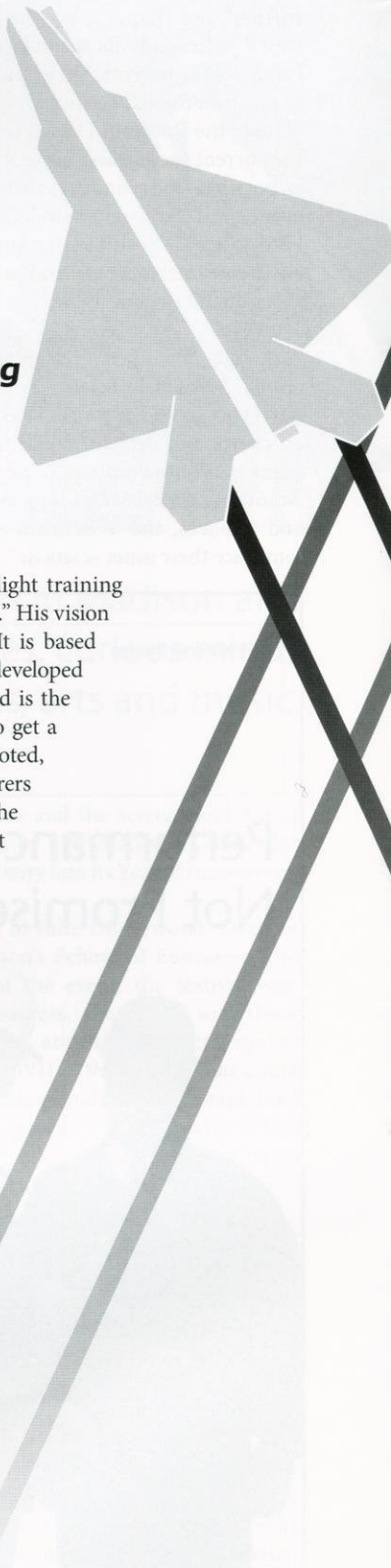
Although not official yet, expect to see the third annual Wisconsin Science Festival to be in a town near you in the future. With the hard working co-chairs and directors, like Julie Underwood and Laura Heisler, the event is sure to continue in popularity and magnitude across the state. According to Heisler, as long as the population stays curious in the arts and sciences, the Wisconsin Science Festival will allow everyone to "embrace their inner scientist." WE

Attendees at the Wisconsin Science Festival watch a demonstration in the Wisconsin Institutes for Discovery building.

Written by: Dayton Sheppard
Photography by: Adam Dircz
Design by: Evan Owens

Smarter Pilots, Safer Skies

Dr. Chris Johnson's innovative flight simulation for pilot training develops a new generation of prepared pilots.



Smarter pilots ... period. This is the motto at Pilot Training System, an innovative flight simulation company founded by UW-Madison PhD graduate, Dr. Chris Johnson. When the magazine last spoke with Johnson in April of 2011, he was working as a manager in the UW-Madison flight simulation lab to produce a training system for pilots that would prepare them for potentially dangerous weather conditions. The simulator uses historical weather data to simulate realistic weather situations that pilots would not otherwise experience in traditional training. Pilots have carried out Johnson's "proof of concept" through demonstration of the simulation. A majority of the pilots made mistakes when they encountered unexpected weather that, in a real life scenario, would have had serious implications. Therefore, this simulation improves pilot performance while reducing the cost of training.

"Until recently, simulation manufacturers have been under the assumption that pilots just kick the tires and jump in"

-Chris Johnson

Since our last meeting with Johnson, he has continued to innovate and evolve the definition of the pilot training process. He has developed his company, Pilot Training System, with funding provided by the Innovation and Economic Development Research Grant awarded to him in spring of 2012. Shortly after receiving this grant, he graduated with his PhD in Industrial and Systems Engineering: Human Factors and Ergonomics from UW-Madison. In the same summer he graduated, Johnson also became a finalist in the Governors' Business Plan Competition for the plan that he created while writing his dissertation.

All of these achievements point towards a primary product meant for the greater good, Pilot Training System. Johnson says, "It is the web-based tool that is the place where pilots and flight training programs can go for any kind of training." His vision for the company is a "virtual hanger." It is based on the weather recreation file that was developed at the simulation lab here on campus and is the emulation of where pilots currently go to get a real-time weather briefing. Johnson noted, "Until recently, simulation manufacturers have been under the assumption that pilots just kick the tires and jump in", but before that can happen there's 20 pages or so of weather briefing that takes place. The "virtual hanger" will disprove this popular misconception and give pilots in training the proper experience prior to real flight. Currently, the Federal Aviation Administration (FAA) dedicates only 2.5 hours of training to simulation.

Johnson believes that, with his "pre-flight experience" system, pilots could see 10 to 15 hours of simulation time before ever flying in a real plane. "Nobody has designed simulation to support pilots' roles as meteorologists," says Johnson, and that is exactly what the simulation training is all about.

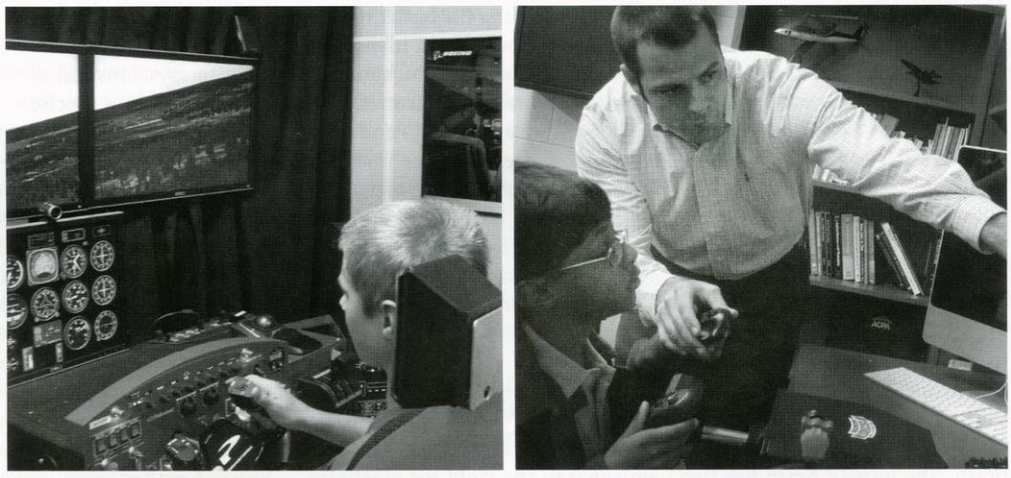
With the development of Pilot Training System well under way, Dr. Johnson is exploring a more specific avenue within flight simulation. He is currently working to fund a project, in partnership with the UW Med Flight Program, which would prepare aero-medical evacuation teams for various weather scenarios that accompany the chaotic nature of the mission itself. It's crucial that, in an emergency evacuation via helicopter, the medical team is efficient and the pilot is prepared for all situations. Pilots must be able to land by vision alone because, if the landing is on a highway or in a field, he or she cannot depend on instrument landing systems. These systems allow the aircraft to travel back to the helipad or airstrip but will not provide any assistance in retrieving a patient who may be in an undesignated landing zone. This is where Johnson's flight simulation training system comes in to play. He will be able to train the evacuation pilots in the poor weather conditions that are likely to be encountered in emergency situations and would otherwise not be experienced in traditional training.

Another aspect of the aero-medical evacuation project involves efficiency. In September, Johnson volunteered to be part of an efficiency study at the trauma center in Hollywood, CA. He participated in moonlight shifts in the emergency center to analyze how well the medical teams worked together when a patient arrived. Johnson stated that he is, "just getting his feet wet in the medical realm," but sees a valuable and promising application of flight simulation within aero-medical evacuation procedures.

Not only is Dr. Johnson's work benefiting aero-medical evacuation teams, pilots, and pilots in training, but also the next generation of aviators through outreach to students. The team at the UW-Madison flight simulation lab has partnered with the Edgewood high school aviation program to begin developing innovative training methods early on. Johnson reported that two desktop simulators were donated to Edgewood compliments of the UW lab. In September, Johnson also participated in the Wisconsin Science Festival. This event allowed students, of all ages, to take a ride in the flight simulator and view demonstrations of the technology's ability to create a better training program for pilots. The event was a success; over 50 students lined up to partake in the flight simulation experience.

The student outreach and community involvement that Johnson strives to achieve is one of the forces that will drive his work into the future. His company is growing and so is the market for a product like Pilot Training System. Johnson's dedication and novel approach to pilot training have been recognized through awards and grants, which have funded Johnson in his vision. That vision is now very much a reality with a bright future and safer skies on the horizon. WE

Written by: Ashley Bredemus
Photography by: Matt Malecha
Design by: Ryan Krull



Dr. Johnson demonstrates his flight training program to students at Edgewood HIgh School.

Discovery: A Whole New Meaning on Campus

The Wisconsin Institutes for Discovery has been successful in its short time on campus.

A university, according to Merriam-Webster's Dictionary, is "an institution of higher education and research that grants academic degrees in a variety of subjects." At UW-Madison, the "higher education" part of this definition is easy to see. Visit campus during the academic year between the times of 9:40AM and 9:55AM, 10:45AM and 11:00AM, 11:50AM and 12:05AM, etc., you will see a flood of bodies, backpacks and bikes in the street hustling between the many educational buildings. The "research" part has historically been exquisite at UW-Madison, but it has visually been harder to find, until now.

The Wisconsin Institutes for Discovery, or commonly referred to on campus as "Discovery," has been shining with success and inspiring curiosity for almost two years now. This $210 million project has been granted two awards since opening in 2010 – the 2012 Lab of the Year award by R&D Magazine and a LEED gold certification for incorporating energy and water saving systems. The building is a symbol of UW-Madison's research that previously seemed hidden. Discovery is home to three organizations: the Wisconsin Institute for Discovery (WID), the Morgridge Institute for Research (MIR), and the Wisconsin Alumni Research Foundation (WARF). WID is a public research organization operated by UW-Madison, MIR is a private research organization sponsored by the Morgridges and operated by WARF, and WARF acts as a landlord since they own two-thirds of the building and is also utilized for patenting purposes. The combination of the three creates an efficient way for many different types of research to get accomplished.

The building was strategically designed for the three organizations to revolutionize research by encouraging different fields to collaborate and solve a variety of problems. Interaction with the community was another major feature taken into consideration when planning the building. The first floor, called the Town Center, is open to the public and invites the community to learn about all of the research being done in the building. The other four floors (lower level included) contain the research labs which are not open to the public. One must realize that WID and MIR are not separated by floor. The majority of the research space is shared between the two entities and is very open to encourage researchers to talk and share ideas. "The Discovery building was built to force people to interact," says Janet Kelly, the Communications Director of MIR and WARF, "You literally do run into people you would not see if you were working in a traditional lab building with many floors, long corridors and hidden labs and offices."

Oftentimes it gets confusing when trying to put together all the pieces that make up this puzzle of a building. An easy way to differentiate everything is by looking at the Wisconsin Institutes for Discovery as a brain. The human brain has two hemispheres; the right for creativity and expression, and the left for logic and mathematical thinking. The public entity, the Wisconsin Institute for Discovery, is the right side of the brain, while the private entity, the Morgridge Institute for Research, is the left side of the brain.

Covering research that is more abstract and creative, WID has teams researching stem cell development based on the external environment, human beings as ecosystems and virtual reality environments (see the magazine's September, 2012 issue) to name a few. Marianne English, who leads the Communications Office for WID, described their focus on something called transdisciplinary research. "The core of our research is to see what different disciplines can get from each other by working together" English says. The idea is that larger questions about the problems faced in the 21st century, such as population growth, higher education, etc., can be approached from multiple disciplines. "Problems don't come in disciplines so why should the solutions?" English says, "Instead of focusing in on a precise aspect of a topic, we want to focus on the overlapping parts of academic fields." If all academic fields were circles of a Venn diagram, making up all educational knowledge, it seems that WID's research focuses on the overlapping parts of the circles.

A huge number of community members and students attend guest seminars in Discovery.

Highlighting more analytical research, MIR aims to advance basic science while addressing some of the world's most devastating diseases such as hepatitis B, AIDS and cancer. Because it is specifically a medical research organization, MIR asks a lot of the same questions as WID does, but approaches the answers in a more direct manner. MIR has research teams working on projects such as regenerative biology, virology, and medical devices. Being a private institute allows benefits such as continuing research with private funds and on private property in situations where the government may not permit certain research using federal or state funds,

Discovery offers an exquisite environment for researchers and students to work.

such has been the case with human embryonic stem cell research in the past. "The biggest advantage is that private organizations can be much more nimble when responding to important opportunities such as establishing new partnerships, hiring scientific talent or purchasing state-of-the-art equipment," Kelly says, "A private institute does not have the bureaucracy and funding restrictions that comes with being part of a public university."

There is a reason why the two parts of the brain are not separated within the body. The two parts have to work together in order for the body to function properly. The same applies to WID and MIR. This goes against the stereotypical vision of what lab research is. Ali Khaleel, a UW-Madison student who also works at the Discovery Welcome Desk, says "Whenever I thought of scientific research, I thought of a few guys in white lab coats playing with petri dishes and microscopes in a small, dark lab. Now I have a completely different idea." Discovery has taken a completely new approach to research. Teamwork and sharing ideas are the most important aspects in this new method.

"Spend an hour, even a half hour. You will discover something truly incredible and unique."

-Ali Khaleel, UW-Madison student

In MIR's perspective, one great benefit of working alongside a public entity is they have access to resources and facilities of a world class public research university. "While few people have heard of the Morgridge Institute because it is so new, such a close association with UW-Madison automatically provides the Morgridge Institute with some credibility and recognition in the scientific world," Kelly says, "At the same time, the Morgridge Institute is hoping to further strengthen research on campus by adding research power and resources." In today's society, it can be a very uncomfortable topic and can almost become a competition between public and private organizations. At Discovery, no rivalry exists. "The idea of combining public and private research is inspiring," Khaleel says, "In the end it really doesn't matter. The goal is always going to be the same: to make peoples' lives better."

The Town Center then acts as the communication device for the brain. It draws the public in and makes known all the research that has been going on. Both the WID and MIR provide brochures and newsletters to inform the public about their research. The Town Center then invites the public in by hosting events and lectures, providing free computer usage and wireless internet, offering great places to dine, in addition to being, simply put, really cool. There are fossils in the floor, chimes that play according to a natural mathematical sequence, and block fountains that can help you keep track of time. "The majority of contacts I get who come to the front desk just say, 'What is this building?' and when I explain everything they are just so mesmerized. People get drawn in because everything looks so cool and then they learn," Khaleel says. Some of the events hosted are the Hackathon: A Bridge between Humanities and the Sciences, Saturday Science as well as many events for the Wisconsin Science Festival. Even events that do not have to do with science promote the public to come in. Last year, for example, there was a breakdancing competition. "It was cool to see something so unrelated to science in a science research building," Khaleel says, "Even though they weren't there to learn, some of the guys were playing around with the interactive walls and learning about what the building is all about."

Once again, Wisconsin is keeping to the state motto: "Forward." The Wisconsin Institutes for Discovery is one of the only research institutes in the world to combine the public and private sector. Others may be attempting to imitate, but we are leading the way. Finally, the research that UW-Madison is known for has a bright, shining face, located right in the heart of campus across the street from Union South. "People who come to UW-Madison say ok here is my bucket list: go to the Capitol, meet Bucky, eat on State Street, go to a football game, etc.," Khaleel says, "Going to Discovery should be added to every one of those bucket lists. Spend an hour, even a half hour. You will discover something truly incredible and unique." WE

Written by: Charlie Duff
Photography by: Aditya Ghule
Design by: Mackenzie O'Dwyer

UW-Madison Joint Effort Propels the Car of the Future

A Hybrid Vehicle team member tries to resize one of the car's parts to better fit with the engine.

With the ever-increasing pressure to create a greener future, car companies and engine producers alike are always looking for new and improved fuels and technologies to reduce their footprint on the environment. Here at UW-Madison, the Engine Research Center (ERC) and the Hybrid Vehicle team have joined forces to develop and implement a revolutionary dual fuel technology: reactivity controlled combustion ignition (RCCI).

A variant of more common compressive fuel technology, RCCI is the combination of at least two fuels with different reactivity, or propensity to react, separately injected into an engine separately. Possible fuel combinations include mixtures of gasoline, diesel and ethanol in various, unique proportions. The lower reactivity fuel is injected first and is allowed to disperse uniformly in air. The higher reactivity fuel is then injected directly into the combustion chamber. The fuel potpourri is then ignited and provides the energy required to operate the engine.

Taking a closer look at the reaction occurring inside the engine provides the porthole to RCCI's enormous benefits. Mixing two fuels instead of using just one allows the reaction to happen at a much lower temperature and greatly maximize the energy efficiency of the engine. The two fuels also pair up in a stoichiometric fantasy of efficiency, as each fuel now has an opposite to combine with, leaving very little fuel wasted or worse, released into the atmosphere as a byproduct.

Harmful emissions are always the base measuring point for how "green" a technology is. Again, RCCI passes with flying colors and easily surpasses the most recent vehicle emission standards. The fresh air that was originally brought into the engine with the low reactivity fuel is much more likely to react with residual carbon, creating carbon dioxide instead of harmful soot, NOx gases, or particle pollution. After a fairly simple implementation, the RCCI technology gets the best of both worlds, creating a lean diesel at an efficient clip .

Hybrid Vehicle team leader, Jake Riederer, dedicated to making RCCI technology a reality for the future, explains the special components of his team's current project.

Despite all these perks, there of course are reasons the technology is still in its infant stages of development. In accordance with the ideal gas law, for the reaction of the two fuels to take place at such low temperatures, the gases must be compressed to extreme pressures. To become a viable technology, the pressures in each cylinder would have to be constantly monitored by computers, which would then make decisions based on those pressure readings. Computers are not cheap, and this technology is no exception.

As with so many groundbreaking ideas, inherent costs have the potential of RCCI tethered for the time being. The key phrase here is "for the time being." As the Roman philosopher Seneca said, "Difficulties strengthen the mind, as labor does the body." Graduate students led by Professor Rolf Reitz in the Engine Research Center here at UW-Madison understand this better than most. After applying for a patent for the technology in 2010, they continue to put in physically and mentally tiring hours in labs refining RCCI.

According to Mechanical Engineering Master's Degree candidate Shawn Spannbauer, at least half of the labs in the research center are dedicated to RCCI. "It's really the research center's cash-cow," Spannbauer says in true Wisconsin form. The research is funded by the Department of Engineering as well as the College of Engineering Diesel Emissions Reduction Consortium, a conglomerate of 24 major industry partners.

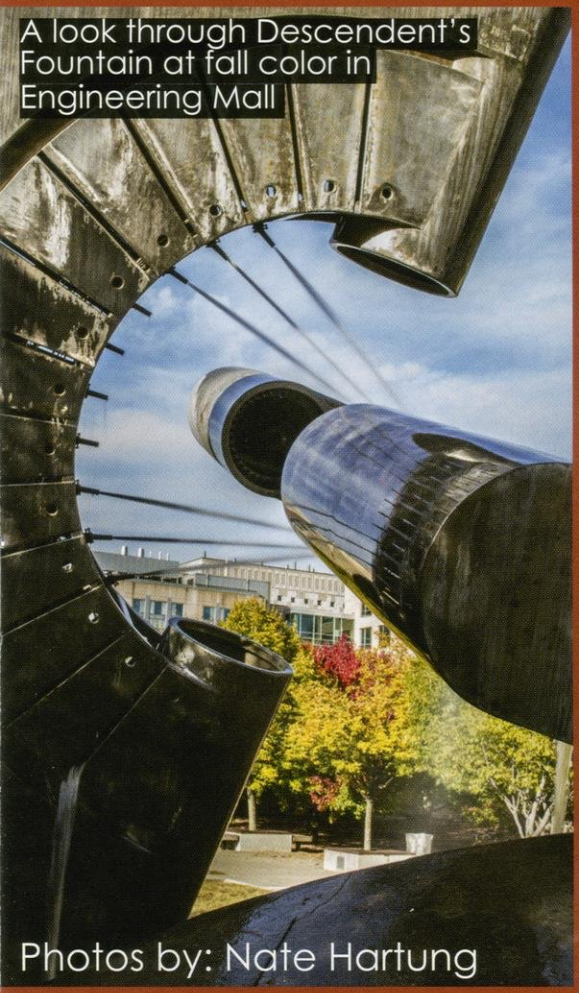
While the ERC provides the technology, the UW-Madison Hybrid vehicle team will provide the implementation. Headed by team leader Jake Riederer, the Hybrid team is currently working on two cars to run on an RCCI engine. No stranger to success, the Hybrid team has won the Department of Energy's Advanced Vehicle Competition six times in the last two decades. Now they're switching gears to convert two of their competition cars to work with the groundbreaking technology. One car will run an RCCI engine and an electric generator in series (meaning one engine will provide power to the other). The second car will function in parallel (both engines operating simultaneously). They hope to have the series car functioning by the end of the school year. Riederer notes, "As far as we know we'll be the first to successfully run a car with an RCCI engine."

Being at the cutting edge of their respective fields is nothing new for the Hybrid Vehicle team or the Engine Research Center. Despite the challenges ahead, both Riederer and Spannbauer are confident that it won't be too long before RCCI takes off and literally fuels the cars of tomorrow. Until then, the two groups will continue to refine and perfect their proprietary technology and reinforce UW-Madison's image as one of the top research universities in the nation. WE

Written by: Phil Condon
Photography by: Sommer Ahmad
Design by: Tanae Swenson

Autumn on Campus

Sun and color on Observatory Hill



A look through Descendent's Fountain at fall color in Engineering Mall

Fall color reflected in a stream near Lakeshore Path

Photos by: Nate Hartung

More autumn photos at www.wisconsinengineer.com

PRESERVING AND IMMORTALIZING THE ICONIC

MEMORIAL UNION

A favorite of alumni and current students, the Memorial Union has been an iconic campus destination since its construction in the fall of 1928 and has remained largely untouched since. To keep the building contemporary and sustainable, the reinvestment project strives to ensure the Memorial Union continues to be a beloved destination on campus for generations to come while meticulously preserving its history. By the means of numerous upgrades, the project seeks to enhance the Wisconsin Union experience through up-to-date and dynamic study, relaxation, and socialization spaces as well as a modern infrastructure.

Mishali Patel, the Memorial Union Student Construction Representative, detailed a timeline for the construction schedule. In June earlier this year, construction began preparation and set-up of the site. "Boldt, the company in charge of construction, worked with both UW-Madison and the Memorial Union to schedule construction around both campus and Union events. They set up and modified things like enclosed pedestrian walkways to maintain the flow around the Union as best possible," Patel says. At the end of July, construction started with the west wing of the Union. "This is when the project really started to get going," Patel says. "During demolition, the outer stone faces of the building were removed in an effort to bring them back for use in the final design, keeping true to the historic aspect of the Union and a sustainable design. The interior elements not being kept are being torn down and problems with asbestos are being removed."

Demolition of the west wing was completed late September 2012.

In October 2012, decisions on furniture and decorations were finalized. "Most people think this step is simpler than it actually is. The process is vital to both the Union appearance and maintaining a construction schedule. It also requires strong coordination between the state representative, the Wisconsin Union representative, the UW-Madison representative, the architecture firms Uihlein/Wilson and Moody Nolan, and Boldt construction," says Patel. "Even with the necessary communication between the parties involved, the project is still on schedule."

The schedule encompasses Phase I of the reinvestment project, focusing on the west wing of the Union. Funded through student segregated fees, revenue generated by Union services, private donations and state

and federal funds for historical structures, the development has a strict budget of $53.2 million. There may be room in the budget for an additional Sunset Lounge that would serve as a pre- and post-performance lobby space just outside the Wisconsin Theatre, adding even more terrace space. The Hoofers space projects to be completed May 2013 and theatre renovations in June 2014, just in time for the 75th anniversary of the Wisconsin Theatre.

After Phase I completion, eventually the Memorial Union will transition into the next phases of construction. "We're focused on the west theatre wing renovation and blurring the line where that is because of the central and east wings that will be renovated in Phase II," says Julie Grove, an architect and project manager working with UW-Madison. "We have the whole of the theatre area to cover and its associated pieces along with all of the Hoofers related spaces. Any time you're occupying the site at the same time as construction is a challenging situation. We're trying to maximize revenues coming in and maintain Union activities while balancing all the construction projects both internally and externally."

However, instead of just focusing on the Phase I construction, the overall design plan is on a macroscopic scale. "We did plan at a schematic design level for the entire site so that it flows and has some continuity when we enter the secondary phases," says Wendy von Below, project manager for the Memorial Union. "That was also done for the interior spaces to achieve a rough design level to hopefully accommodate for all future needs." Materials selection was done through a master planning effort on a conceptual level for the building as a whole so that durable, long life materials can be cohesive with the secondary phases of the construction.

Because of the historical nature of the building, steps were taken to ensure the best effort was put forth. A series of workshops examined what makes the Union the Union, and what the necessary elements were to keep the same design in both the first and secondary phases. "Continuous thread ideas like terrazzo flooring that you might see downstairs already or glass blocks from the theatre or some of the limestone detail the idea that we have very historic spaces and a preservation plan in place to expand the historic nature across all phases," says von Below. The Wisconsin Historical Society helped the Union implement the plan. "There was a set level for the level of preservation detail required and we have tried to follow that as closely as possible," says Grove. "We've done things like a paint layer study to determine the original color of the room before any modifications. We really rolled up our sleeves and did our homework before we started."

Current demolition and construction has removed the connecting piece between the theatre area and the central wing of the union. Multiple levels were removed to improve the Union's ease of access, and universal accessibility was achieved. "This became part of the first concept the design team presented; they removed the connector piece and took down everything between the two wings. That will allow us to create an entirely new west entry to guide visitors into a new lobby and realign with the stairs and elevator," says von Below. Through the refurbished entry and hall, visitors will be able to stand at the entry and see the lake through the entire space, effectively guiding them through the building.

In early October 2012, a small fire started in a portion of the Wisconsin Union Theater under construction. Fortunately, the renovations incurred only minor damages. "The damage that occurred was confined to an area where demolition work is occurring," says von Below. "There is no impact to the construction schedule or to the renovation plans." Because the fire was quickly contained and extinguished, there were no injuries to any workers and the project could continue as scheduled.

The rest of the renovations in the west wing add a new element of character to the building. "The overall improvements to the west wing greatly improve the quality of the space," says von Below. The play circle's telescoping, retractable seats allow for a dynamic environment that can be customized for each event. The theatre will be restored to its entirety, even with custom carpets reflecting back to the original art modern style of the 1930s, and will improve on the already excellent acoustics. The renovated Hoofers area and Mendota lounge will create a study space directly at water level with incorporated historical pieces that were saved over time.

Before the design and construction, there was an overwhelming response of people offering their input for renovating the Union. "We brought the public in to bring insight and gather any concerns to try and incorporate all ideas," says Grove. Unfortunately, not everyone is aware of the painstaking efforts made by the design team for historic preservation. "Recently, I overheard a conversation between some campus community members in which they described how much of a shame it was that the Union was being torn down," says Grove. "We're really trying to convey that the Union isn't going anywhere. After the reinvestment project, the building will be a cleaned up, dressed up version of what it is today and nothing will be lost in the process." In 1948, Time magazine summed up the Union's atmosphere, stating, "It's almost impossible not to have a good time at Wisconsin," as quoted in the 1992 August edition of the Wisconsin Engineer Magazine. The statement held true then and still does now. Through the conservation efforts, the Memorial Union will be preserved and immortalized for the enjoyment of generations to come. WE

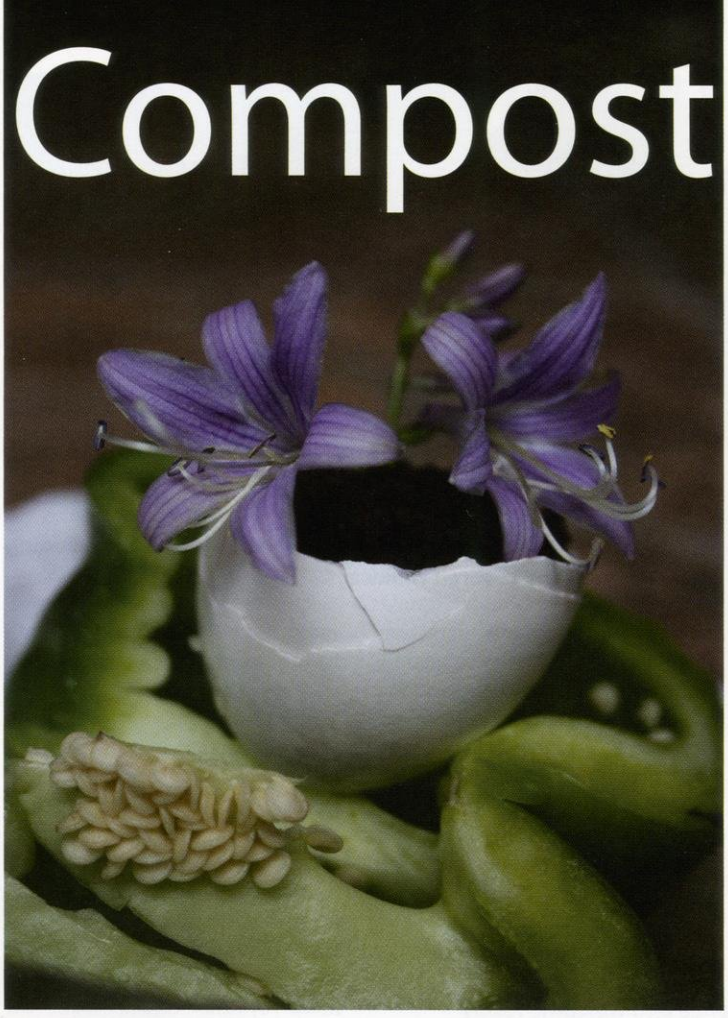
Many changes are noticeable around the Memorial Union, including road closures and covered walkways.

New and upgraded features:

- **Integrated southwest entrance and welcome lobby**
- **Hoofers boat storage and office space**
- **Outdoor brat stand**
- **Better connection to the lakeshore path**
- **Dynamic play circle**
- **Renovated basement space to better highlight craft store**
- **Study and group reservation spaces**
- **Overall interior face-lift**

Written by: Steve Wishau
Photography by: Alex Steinhauer
Design by: Akhilesh Dakinedi

Compost Get the Dirt



With all of the green initiatives present today, the task of mitigating climate change can seem overwhelming; yet it is every day actions one makes that can make the biggest impact in conservation. When throwing away waste it is a natural reaction to toss everything into a garbage bin, but it is this small act that leads to 250 million tons of trash to be thrown away each year in the United States, according to the Environmental Protection Agency. This amount of waste could form a line of filled garbage trucks that reaches the moon; fortunately there are two simple solutions to this problem: to minimize the amount of waste one generates and to choose composting or recycling over the trash. More than 40 percent of the food in the United States is thrown away according to the Natural Resources Defense Council, which makes Americans 10 times more wasteful than a person from Southeast Asia. When waste is necessary, choosing to compost or recycle when it is permissible boasts a list of enticing benefits. The information below highlights what can and cannot be composted, how to compost and why one should start composting. WE

How to Compost at Home

The easiest way to begin composting if you live in the Madison area is to collect compostable materials in a sealed container and drop off the materials at one of the sites below every week. To keep your home compost bin clean use a paper bag liner, which can be composted with your food scraps. An alternate option is to create your own composting bin to place outside; visit the Popular Mechanics website for an easy way to construct your own rotating compost bin (http://www.popularmechanics.com/science/environment/waste/4234559?click=main_sr).

What To Compost

- Fruits and vegetables (including peels, cores and stems)
- Breads and pastries
- Pasta
- Coffee grounds and coffee filters
- Tea bags
- Clean paper, cardboard and shredded newspaper
- Compostable packaging
- Eggshells
- Nut shells
- Dryer and vacuum cleaner lint
- Houseplants
- Leaves, hay, straw, hair, fur and grass
- Yard trimmings

What NOT To Compost

- Meat and bones
- Fish
- Dairy
- Eggs
- Rice
- Charcoal
- Walnut branches
- Nuts
- Fats, greases, lards orw oils
- Limes
- Corn cobs
- Plastic or otherwise heavily-coated materials
- Pet or human waste
- Used personal hygiene products
- Yard trimmings with pesticides
- Diseased or insect ridden plants

UW-Madison Compost Drop-Off Locations:

- Lot 62 (across from the Nat)
- Lot 76 (the North side, near the Goodman Softball Complex)
- The Crossing (under construction)
- Parking lot behind the Kohl Center (under construction)

Written by: Kate Slattery
Photography by: Tyler VanFossen
Design by: Tanae Swenson

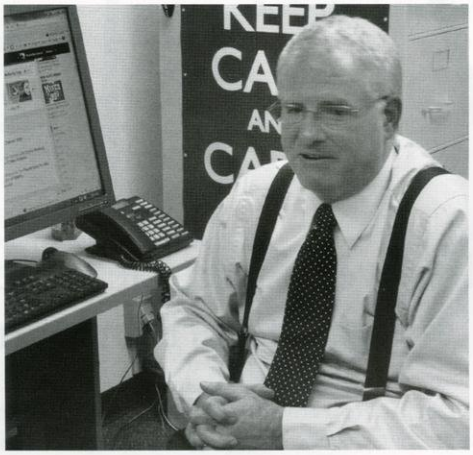
Social Engineering: The Methodology of Deception

The essence of trust requires years or even a lifetime to construct, and yet so many are exploiting this virtue. Scammers and frauds are prevalent in every society; they take advantage of humans' unwatchful nature to obtain material goods or confidential information. With the introduction of social networks and electronic communications, deception has transformed into digitalized crime. Social engineering is a form of deception to gather information, commit fraud or gain computer system access.

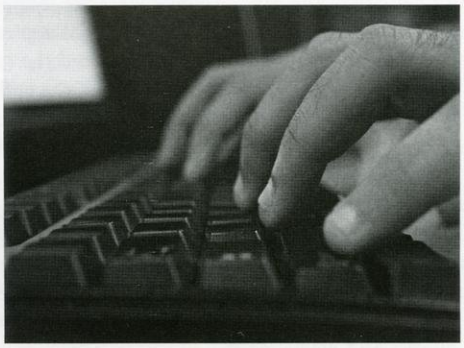
It is understandable to confuse social engineering as a discipline of engineering science because professional engineers apply mathematic and scientific principles to problem solve and improve people's quality of life. However, social engineers exploit the weak communication link between people for personal gains. Similar to the traditional disciplines of engineering, social engineers utilize a complex methodology and follow a series of sophisticated steps which can be viewed as a form of science.

Today, the increasing reliance on technology shifts the traditional data storage in a file cabinet to an electronic environment. Although the digital revolution simplifies the strenuous task of information retrieval, it also increases the risk of unauthorized access to personal records such as bank numbers, student records, or even a large cooperation's financial tactics. The most popular form of social engineering is pretexting, which is when an individual lies to obtain privileged data. These experts will disguise themselves to either gain access to restricted areas or deceive authorized personnel to help them do so. "Social engineers are experts in leveraging human emotions" says Nicholas A. Davis, the UW-Madison IT Security Architect. The signifying difference between authentication and identification is the presence of evidence. Often times, a social engineer will identify themselves as another through physical appearance, body language or knowledge of specific information, but they are unable to provide the evidence to verify their identity when asked for. For instance, an accountant working at a law firm receives an anonymous call from a stranger stating that he is an officer from the fire department and, as required by law, he needs a routine inspection of the accountant's workplace for fire safety hazard. The accountant is therefore obligated to comply with safety laws and give the officer a tour of the building. Since physical identification was not asked, the officer, in reality a social engineer, is able to gain access to the building and obtain classified documents.

Another type of strategy widely employed by these engineers is the use of Trojan horses. A



Nicholas A. Davis, IT Security Architect at UW-Madison, explains social engineering.



Easy access to confidential data

Trojan horse is a code insidiously hidden in seemingly harmless files and when opened, it latches onto the host computer. From this code, a computer programmer can remotely initiate transfer of documents or infect other devices connected to the same network. Sometimes, elements of deception are also used to embed the code. For example, a social engineer, after conducting thorough background research, will send the victim a friendly email posed as an acquaintance and requesting the victim to open an attachment along with the email. On July 3rd, 2012 a group of espionage campaign hackers based in China, sent out multiple emails to intelligence contractors and security consulting firms such as Chertoff Group and EnergySec. Those emails, although seemingly harmless, contained documents and links that bait the users into downloading a malicious code. Cyberweapons of this intensity are relatively common; hacking humans are much more effective and simple to execute than hacking computer systems. "It's really hard for someone to take money out of your bank account, but it is easy to make you willingly give it out," says Nicholas.

Many countermeasures can be taken to prevent an attack of this scale. Since social engineers feed on human's vulnerability to trust, it is essential to be wary of suspicious behavior. The best prevention is to properly store sensitive documents and restrict people's access to personal records. "Private information is like your toothbrush, not meant to be shared" says Nicholas. When possible, it is best to ask for identification to verify that someone is who they claim they are. It is also a good practice to filter published information. Social engineers can easily obtain family information through websites or even newspapers. Obituaries, for example, provide a wealth of family history that may be useful when gathering the victim's background information. A person who may sound like they are trying to force information out of people may be a social engineer. The evolution of technology introduces much more insidious methods of exploitation; to better equip ourselves against these threats, it is best to redefine the naïve concept of trust. WE

Written by: Jesse Wang
Photography by: Nishant Mehta
Design by: Xiaoshen Zhang

What Matters Most

Discovering the Higgs Particle

Physicists discover a particle which could be the missing link in describing where all mass originates.

Picture yourself as part of a team that is given the task of learning the mechanics and assembly of a car, except that you are not allowed to directly observe it or take it apart by hand. What would you do? After a few minutes of thought, some common ideas might be to use sonar to learn the overall shape and density of the car, or infrared to determine the heat sources. Suddenly, a voice from the back of the room suggests that you bang it against something and see what flies off.

While this example might seem a little crude, it does exemplify the underlying process scientists use to examine the minute pieces of our universe. Around 13.7 billion years ago, a collision occurred that changed the very structure of the universe. While we cannot begin to know the state of anything before this time, science is beginning to unravel the mystery of the very particles that now make up our existence.

In less than 10-22 seconds after this "big bang," quarks and electrons were created, which quickly grouped together to form protons and neutrons. It is impossible to conceive the amount of energy needed to produce this type of collision, or the heat expelled from it. However, physicists at the Large Hadron Collider (LHC) in Geneva, Switzerland are reaching energies equal to those just moments (10-15 seconds) after the big bang.

Let us go back to the car example for one moment. In the first experiment, you decide to speed the car up to 30 mph, and crash it into a wall. A few major parts here and there may come off, but nothing too exciting. So the next time you decide to crash the car at 100 mph. Now pieces are flying everywhere, allowing you to start reconstructing the overall makeup of the car. For your last experiment, however, you decide to speed the car up as fast as possible, and crash it at 500 mph. At this speed, the entire car will be demolished, leaving you with pieces that you never knew existed before, giving a detailed explanation of the overall makeup of the car.

The same holds true for collisions happening in the LHC. Physicists there were able to produce collisions that were never possible before, and this opened up a whole new range of opportunities for discovery. One of these particles that became feasible to discover due to the new capabilities of the LHC was the Higgs boson particle.

The Higgs particle has been a missing link in Standard theory, which models the relationship between three of the four forces that govern our universe – strong, weak, and electromagnetic – and the sub-atomic particles that we know of. One of the main flaws with this model is that it does not account for where particles acquire their mass. The Higgs boson is believed to be the connecting piece, as it gives all particles their mass.

Sau Lan Wu, professor of physics at UW–Madison, described the Higgs field in a lecture given at the Wisconsin Institutes for Discovery. She said to imagine the Higgs field as a room full of scientists standing around and talking to each other. At one point, a random person walks into the room and through the crowd of people, quietly weaving his way without making too much of a fuss. Suddenly, Albert Einstein walks into the room. As soon as he begins to try and walk through the crowd of people, all of the scientists converge around him, forcing him to slow down.

Similarly, Higgs particles (scientists) are all around us, and while some of them, like that first random person, can move through the Higgs field without attracting much attention from the Higgs particles, others are extremely attractive, and become much more massive as the Higgs particles begin to attach onto them.

However, the major problem in detecting Higgs particles comes from its rapid decay rate, something to the order of 10-22 seconds. So the big question then becomes, how do you detect something that disappears almost instantaneously? The answer: you find the rare pattern of particles that it decays into. Enter the CMS and ATLAS experiments happing at the LHC.

The search for this missing boson particle was split into two different teams at the LHC. They each were independently tasked to find the Higgs particle using two different types of detectors. I spoke with Wesley Smith, professor of physics at UW-Madison, about his involvement on the CMS team, as well as UW-Madison's overall role in the project.

Inside the CMS detector, beams of energy collide every 25 nanoseconds, resulting in around 20 proton-on-proton collisions. This adds to about one billion collisions per second. With such a large number of collisions to be examined, a trigger system was designed to sift through the billions of collisions that just record background radiation and pick out the important results. This is a two-stage process, where the first stage eliminates about half of the recorded collisions that were not important, and the second stage chooses around 400 of those events to be further examined. All in all, in only one in a trillion events is a Higgs particle observed.

Smith was directly involved in designing the trigger system for the CMS project, as well as the construction and commission of it. This large project included about 100 physicists and engineers from tens of different countries, as well as a conglomeration from the University of Wisconsin. Speaking about the role UW-Madison had played on the ATLAS and CMS teams, Smith said, "[The University of Wisconsin] was not just participators, but played a leading role in this project."

All of these efforts culminated on July 4th, when CERN announced the discovery of a "Higgs-like particle." Further experiments will be necessary to examine the characteristics of this new particle, but they reported that the probability that the particle they discovered was instead random background radiation to be one in three million, or confident out to five standard deviations.

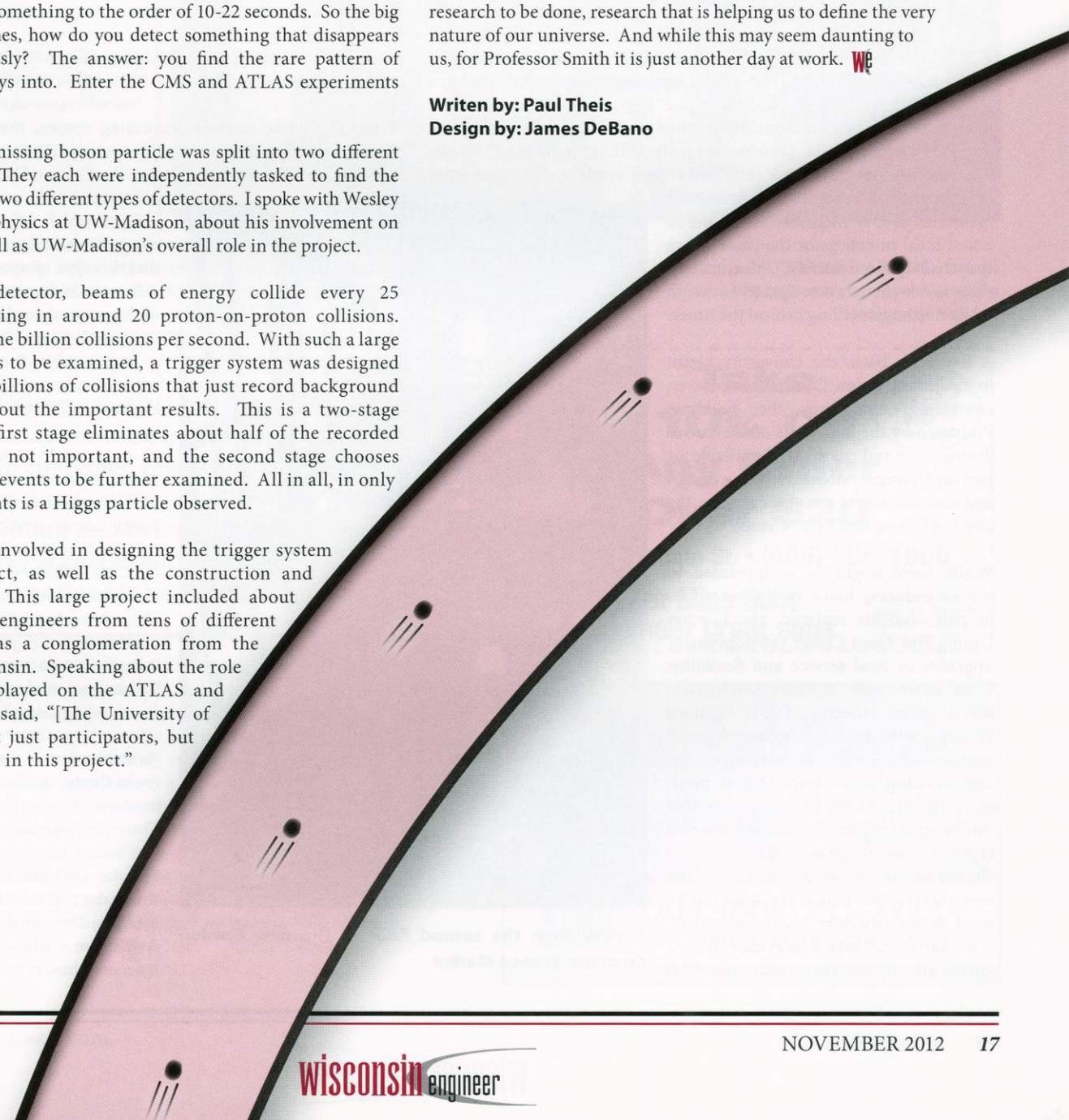
"You build this big machine and you hope that all your theories are right and all your predictions are correct and say, 'It should be here'"

-Wesley Smith

When I asked Smith about this tremendous breakthrough, he said, "You build this big machine and you hope that all your theories are right and all your predictions are correct and say, 'It should be here', but now we start the work." He described it as a new era for physics, saying that, "The actual discovery that it's there is extremely exciting, [but] the reason to look for it was to do all the science with it."

In the end, Smith and the rest of physicists are left with exactly what they wanted, more questions to be answered. While this was a monumental discovery, it opens the possibilities for decades more research to be done, research that is helping us to define the very nature of our universe. And while this may seem daunting to us, for Professor Smith it is just another day at work. WE

Writen by: Paul Theis
Design by: James DeBano



Moving Forward With an Eye on the Past

A New Story Starts with the Grand Opening of Gordon Commons Dining & Event Center

Think back to the days when almost all of your meals were a two minute walk away. For most freshmen living in the southeast dorms at UW-Madison, that one stop shop was the cafeteria known as Gordon Commons. Established in 1965, Gordon Commons provided thousands of housing students with a traditional, single-line cafeteria operation that distributes three meals a day. Many view the building as a home to their earliest memories of UW-Madison, as the site of a first meal in college or the place where they made lifelong friends. Unfortunately, there is not enough nostalgia to outweigh an establishment falling behind the times.

A few years back, the University began to examine Gordon Commons and even considered renovating the building. Prompted by the high costs of alternative dining plans and nearby land available for use, the University decided to begin design and construction of the new cafeteria, the Gordon Dining and Event Center.

While some might be disappointed to see an enduring home of the memories of past students replaced, the Gordon Dining and Event Center provides major upgrades in food service and flexibility. I sat down with Michael Kinderman, the Assistant Director of UW-Madison Housing, who described a sharp sense of contrast between the two buildings. "The new building offers space that is much more flexible. There are big rooms that can be split into smaller rooms, different types of meeting spaces... There is also a change in the way food is prepared. The new marketplace makes the food out in front of the customer instead of setting it out on a line" says Kinderman. With a greater amount of transparency and a high variety of food, the Gordon Dining and Event Center is intent on catering to the customer's desires.

A view from the second floor of the new Gordon Common Avenue Market

With 12 diverse marketplace dining venues, three dining areas with seating for 600 students, a meeting room with 750 seats and floor-to-ceiling window views of the Kohl Center, the Gordon Dining and Event Center is expected to be a vibrant centerpiece on campus which offers students a place to enjoy themselves and relax. It is safe to say that this type of open space is a pleasantly different dining complex than students were previously used to. Gone are the days when students had to wait in long lines only to find that their fries were cold. With new options and more space students are now the focus of the operation.

In terms of its design, Architect/Project Manager Stuart LaRose highlighted some of the features of the Gordon Dining and Event Center which distinguish it from the old Gordon Commons. "The old building had a mid-sixties new modernist look which made it feel a little too austere. The articulation of materials in the new building is much greater. There is more to it than just concrete and glass. It fits with the modern student and into the modern surroundings" says LaRose.

As impressive as the Gordon Dining and Event Center is, there is still more work to be done. Eventually the existing Gordon Commons faces demolition this November, but before that the building underwent asbestos abatement in October for about thirty days. The entire demolition process is targeted be completed over winter break. As for the surrounding area, at least one lane of Johnson Street will be closed as

A look inside Flamingo Run, a one stop shop for students

The entrance o the new Gordon Avenue Market

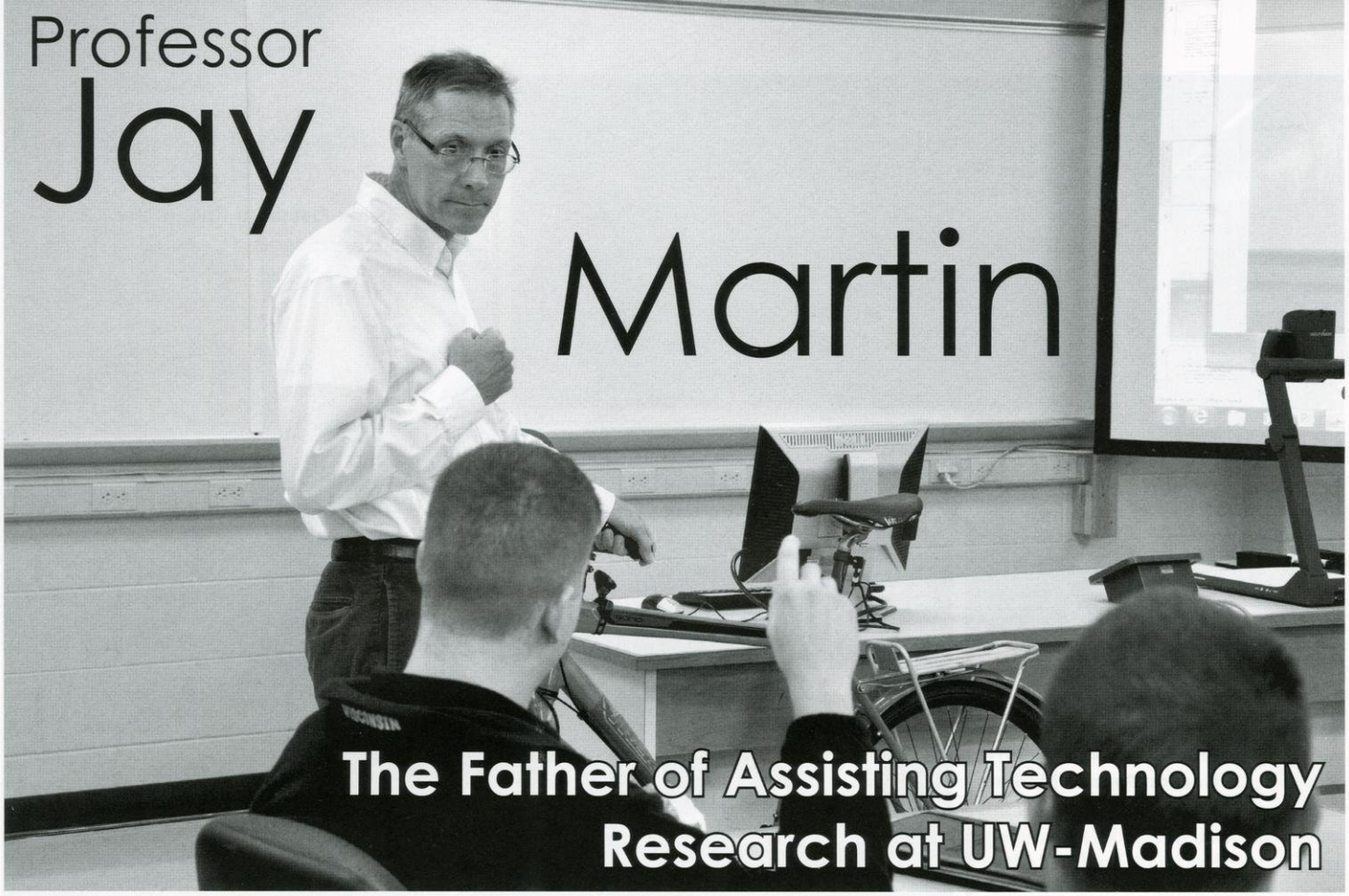
the demolition is underway. Following the demolition of the old Gordon Commons, a green space will be created in the very same spot that it once stood. This recreational green space will be completed in August 2013 and will successfully extend East Campus Mall.

Much in the same way that the life of Edgar B. Gordon is still honored in this new dining facility, the cherished memories of past students in Gordon Commons will live on while the Gordon Dining and Event Center provides students today with a chance to make lasting memories of their own.

Most would probably agree that the Gordon Commons of the past will soon be forgotten due to the stunning size and nature of the Gordon Dining and Event Center. One thing, however, that has not changed is the goal of honoring Edgar B. Gordon. Known for his techniques that effectively taught music via radio to approximately one million rural Wisconsin children, Gordon is still remembered as a music pioneer through our dining facilities. In fact, some of the meeting rooms in the Gordon Dining and Event Center are named after musical terms such as the Concerto, Sonata and Overture meeting rooms. Much in the same way that the life of Edgar B. Gordon is still honored in this new dining facility, the cherished memories of past students in Gordon Commons will live on while the Gordon Dining and Event Center provides students today with a chance to make lasting memories of their own. We

Written by: Matt Latusrek
Photography by: David Virgillio
Design by: Yuli Liu

Professor Jay Martin



The Father of Assisting Technology Research at UW-Madison

Not all professors at UW–Madison hold their positions in as high esteem as Professor Jay Martin does his. Martin, a professor of mechanical engineering, values the opportunities his position at the university provides him. "I feel a very strong sense of responsibly to do things that this position will allow me to do that maybe other people cannot," says Martin, when asked about his role as a professor. Throughout his life, Martin has been improving the lives of those around him. After receiving his undergraduate degree in physics from Indiana University, Martin served in the Peace Corps for two and a half years teaching physics and calculus in a secondary school in Kenya. Now, at UW–Madison, Martin is changing the lives of people with physical disabilities through his research in assistive technology.

Over 11 years ago, Martin co-founded UW-CREATe (Center for Rehabilitation Engineering and Assistive Technology) with the help of Professor Frank Fronczak, Professor Nicola Ferrier and the late Professor Terry Richard. In his own words, Martin describes UW-CREATe as "a cooperative effort of faculty and students." He says, "The objective is to develop and use technology to assist with any sort of disability." With UW-CREATe's success, hopefully more people with disabilities will be able to live independently. UW-CREATe's work is often focused on general advancements in the field of assistive technology. The group has significantly improved the bone modeling process in addition to enhancing the process by which human motion is captured and modeled. UW-CREATe also works with individuals on a case-by-case basis. Recently, they designed a tricycle for a child who was not able to operate the standard tricycle handlebars. To accommodate this challenge, the team developed a steering system that was able to be completely controlled by the child's lower body. The idea for UW-CREATe came to Martin as he spent much of his time visiting hospitals in late 1999.

In July, 1999 Martin's oldest son was involved in a diving accident that left him paralyzed from midchest-down. Subsequently, Martin spent the majority of his time the next few months in hospitals and other medical facilities. He rapidly recognized how poorly designed technology was for those who had disabilities. "There was so much need for design work in assistive technology," says Martin; he noted the assistive technology of the time was "often unsafe or didn't meet the intended function." As he was being exposed to all of this, he also realized how much of the necessary technology didn't exist at all.

At the time, Martin was the director of the Engine Research Center on campus. He was successfully established in the field of engine research, but soon after his son's accident, he realized that he was no longer comfortable in the position. Martin felt he needed to work in an entirely different field—a field where he could a make a world of difference for those with a bleak outlook for the future.

Martin consulted Professor John Mitchell, a colleague Martin considers a mentor. After hearing Mitchell's positive feedback on his idea, Martin went to Professor Neil Duffie, the department chair at the time. Duffie, too, thought that Martin had a fantastic idea. Mere months after realizing the need for improved assistive technology, Martin co-founded UW-CREATe. "I often think that if I hadn't been [at UW–Madison], that wouldn't have happened," says Martin. Soon after UW-CREATe was founded, Martin started receiving requests from fellow faculty members and students who wanted to help. Martin, excited to share his mission with others, gladly accepted their offers.

Martin's group has expanded since its inception 11 years ago; it is now comprised of around 35 members. Six faculty members are active in UW-CREATe, and the rest of the members are students—

Professor Martin with his ME601 class.

graduate and undergraduate alike. Currently, the project of UW-CREATe that Martin is most excited about is a wheelchair—perhaps the most innovative wheelchair ever designed. Typical powered wheelchairs draw their power from extremely heavy batteries that total around one hundred pounds. One key feature of UW-CREATe's Advanced Powered Wheelchair Systems Project (APW) is a hybrid power system. A propane engine is included to significantly decrease the weight of the wheelchair as well as improve its overall efficiency.

"I feel a very strong sense of responsibly to do things that this position will allow me to do that maybe other people cannot."

-Professor Jay Martin

The APW is made up of many innovative components. A small, robotic arm will be attached to allow the user to perform everyday functions that are simply daunting to a person with physical disability. Some of these functions include pushing elevator buttons, opening and closing doors, and operating vending machine buttons. The wheelchair will also include seat heating and cooling capacities as many users are very temperature sensitive. In addition, APW will incorporate an airbag system to ensure the safety of its passenger. The airbag system is designed to protect the passenger in the case of a wheelchair tip-over or an automobile accident (in which the wheelchair is secured within the vehicle).

Advanced Powered Wheelchair Systems Project can be thought of as a multi-component test run. Most of the components that make this wheelchair unique have never before been implemented in the field of assistive technology. If components of AWP's design prove to be successful, it is likely that they will be included in the large-scale manufacturing of powered wheelchairs for years to come.

Professor Martin with Associate Professor Pfefferkorn standing with the wheelchair.

It is clear that Martin harbors a deep passion for the field of assistive technology. With other engineering research fields, the opportunities for unprecedented projects are few-and-far-between. Martin remarks that "this field is so wide open."

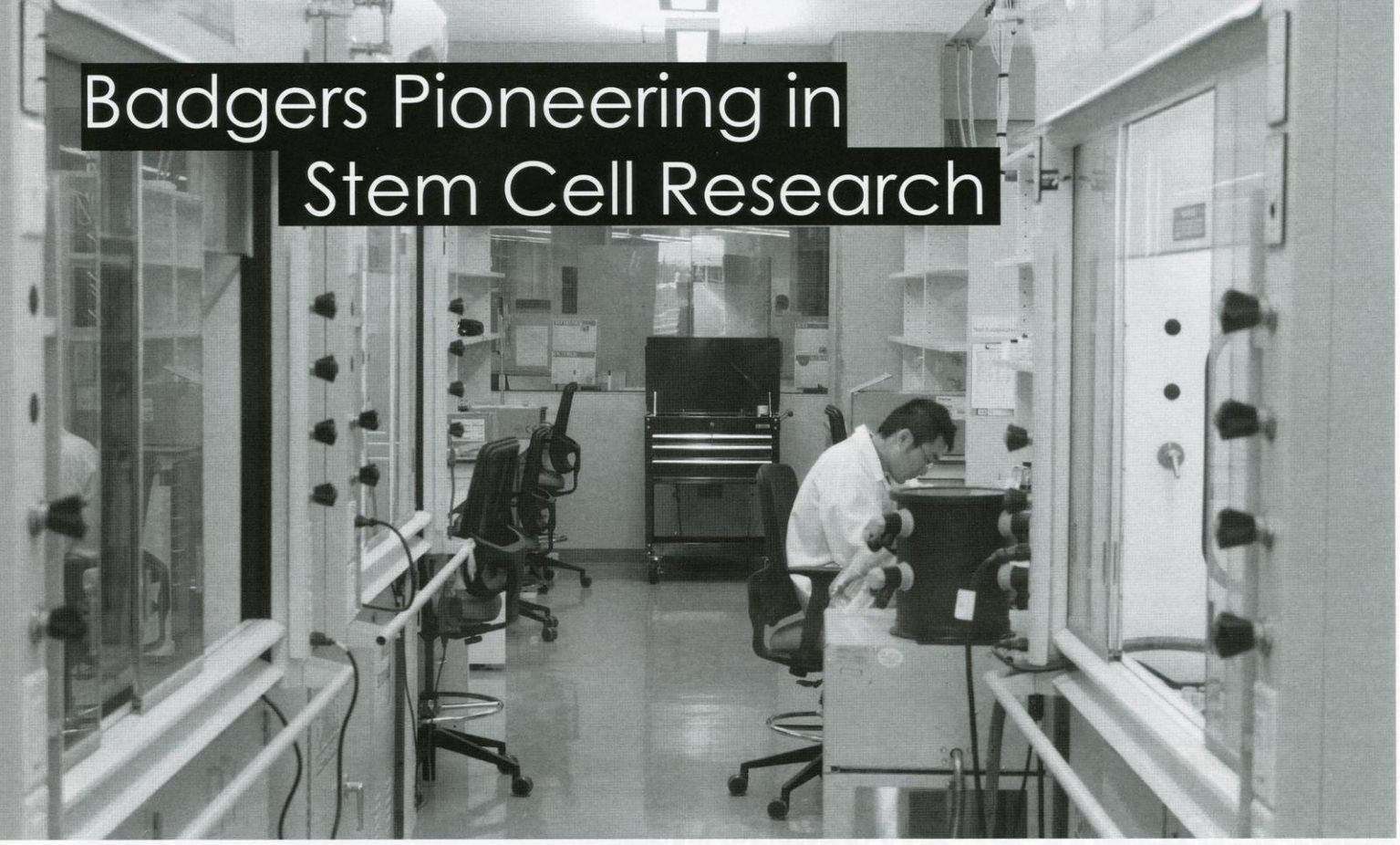
While Martin thoroughly enjoys his research in assistive technology, he also adores other aspects of his job. One of his favorites is advising; Martin serves as an official advisor to students, but loves to provide guidance to any student who seeks it. Martin delights in helping students make big decisions; he sees laying out options and predicting implications as exciting and worthwhile.

Martin feels it is his obligation to use his position to make a difference in the lives of students and the community around him. "I think that, for me, the best position is professor. And I also happen to think that the professor position is such an amazing position because of the freedom that you have and the potential ability you have to affect students. I always treat this position with a lot of respect," Martin responds when asked about his job. Martin has truly found his home at UW–Madison. WE

Jay Martin was also featured in the December 1993 issue of the *Wisconsin Engineer Magazine*. The article can be found within our archives at www.wisconsinengineer.com

Written by: Tim Carlson
Photography by: Catie Qi
Design by: Madison Boston

Badgers Pioneering in Stem Cell Research



According to the Centers for Disease Control and Prevention (CDC), seven out of ten deaths in America are due to chronic diseases. The leading culprits include diseases of the cardiovascular, cerebrovascular and respiratory systems as well as liver, Alzheimer's, and Parkinson's disease.

This is where the role of stem cell research becomes increasingly important.

According to Brenda Ogle, chair of the Stem Cell Bioengineering Focus Group of the UW Stem Cell and Regenerative Medicine Center, stem cell bioengineering is the process of how cells sense, interact, and respond to their environment. Ogle says, "Such cells are then used to repair or replace damaged organs."

Unknown to many students, UW- Madison is a hot spot for high profile, cutting edge stem cell research.

Stem cells are the basic cells found in all organisms and are either classified as embryonic or adult. Embryonic stem cells are naturally pluripotent; they have the capability to divide into different functioning cells such as blood, brain, muscle, or heart. Adult stem cells' function cannot be altered and are consequently less useful in their natural state to biologists and engineers.

Embryonic stem cells are more valuable, but due to the fact they are harvested from an early stage embryo, their use is much more controversial. Adult stem cells raise fewer ethical and moral questions. They are extracted from adult patients by drilling into the bone and removing bone marrow, using liposuction to extract adipose tissue, or drawing blood and running it through a machine to capture the stem cells.

Currently at UW-Madison, the newly opened Morgridge Institute for Research in the Wisconsin Institutes for Discovery (WID) houses biologists, engineers, and other scientists that are researching the development of such stem cells.

James (Jamie) Thomson, Director of the Regenerative Biology department in the Morgridge Institute for Research, is a major contributor to UW-Madison's success in stem cell research.

Thomson has made many remarkable advances in the field, starting with a 1995 discovery in which his lab was the first to successfully isolate embryonic stem cell lines from a non-human primate. In 1998, Thomson was featured in Science Magazine's "Scientific Breakthrough of the Year" issue for being the first to successfully isolate human embryonic stem cell lines.

In addition, Thomson was featured on the cover of TIME Magazine's 2001 issue of "America's Best in Science in Medicine" and later made TIME's 2008 list of the world's most influential people, all while working at UW- Madison. Listed among names such as Barack Obama, Oprah Winfrey, Steve Jobs, and Michael Bloomberg, Thomson made the cut as one of the world's most influential people for his lab's discovery of the isolation of human induced pluripotent (iPS) cells.

iPS cells allow the less controversial, yet less pluripotent, adult stem cells to be induced and mimic the controversial, naturally pluripotent embryonic stem cells. Research which has opened many doors for scientists, biologists, and engineers in the field by enabling them to work on stem cells and without the controversial use of embryos.

Kris Saha, an assistant professor in stem cell bioengineering, says, "The human stem cell community here is really phenomenal. It is really one of the top in the world, and it has a great start because Jamie Thomson's lab has done so much in the field."

Assistant Professor Kris Saha is new to the UW-Madison campus from the Whitehead Institute for Biomedical Research at MIT/Harvard University where he conducted his post-doctoral work. Saha first came in contact with a professor at MIT and Harvard by entering a paper competition while a graduate student at the University of California, Berkeley.

"There is a pretty long delay to get human embryonic stem cell lines. I wrote about finding a better way to try to track them from being derived at clinics to being distributed for the public good," Saha says.

One of the judges on the panel for the paper competition recommended Saha to deepen his understanding of science and ethics by taking a few classes that were less technical and more societal in nature. Consequently, Saha was led to apply to, and later be awarded, the prestigious Society in Science fellowship.

The Society in Science fellowship finds the world's best post-doctorate candidates who are interested in not only revolutionary technologies, but also their impact on society. Saha says, "That experience was really eye opening for me. It led me to all sorts of projects I don't think a normal biology post doc would be able to do."

Assistant Professor Kris Saha at the Wisconsin Institutes for Discovery

Still very interested in the societal impacts of his research, Saha is more than excited to form his lab and hopes to find a few students interested in interdisciplinary work. "You never know where alumni will end up, but I'm hoping the people who go through my lab will think seriously not only about what they research, but about how it connect to what's happening worldwide," Saha says.

Saha's lab is one of four labs which comprise the BIONAnocomposite Tissue Engineering Scaffolds (BIONATES) department in the WID under the direction of Jamie Thomson. These four labs are named after their 'theme' leader and include the Saha, Turng, Gong, and Ashton Labs.

Ethan Lippmann, a post-doctoral student in Dr. Randy Ashton's lab, speaks of the atmosphere he has witnessed while working at the WID. "The concept of the building is collaboration, and Jamie Thompson was great about getting that set up," Lippmann says. For example, Saha plans to work in collaboration with all BIONATES labs but studies topics that most closely relate to the work being done in the Ashton lab.

Saha's research involves engineering the inside of the cell such that it is harmonious and talks with the functionality that can be engineered outside of the cell. "I will not only have to think about the outside of the cell, but I will have to work with other labs, such as the Ashton Lab, to communicate with the inside of the cell to change the cell signatures," Saha says.

Likewise, Ethan Lippmann of the Ashton lab speaks of the team's research and how they are receiving beneficial knowledge and expertise from Kris Saha. In the Ashton lab, Ethan is performing tests on arrays of hundreds of different concentrations and combinations of genome factors to produce a particular phenotype.

There is a specific gene associated with each phenotype that Ethan and other members of the Ashton Lab are trying to produce. Lippmann says, "If we can make it report when it is on, that makes our screening a lot easier. Kris is an expert in genetic manipulation of stem cells to make them report in a specific way, and he is teaching us some of his techniques."

Ethan Lippmann and Kris Saha both stress how beneficial it has been to their research to have multiple engineering and science disciplines working together at UW-Madison.

Unlike where Lippmann completed his graduate work in a single discipline lab, the Ashton Lab consists of members from multiple engineering majors. "The mechanical engineer in our lab knows how to build everything. As the chemical engineer, I am helping with fluid flow; we also have biomedical engineers and polymer engineers. It helps to be more efficient and get a lot more done," Lippmann says.

Similarly, Kris Saha comments that the collaboration and progressive atmosphere on UW-Madison's campus as a whole is part of the reason he chose to work here following his post-doctoral work at MIT and Harvard Universities. Saha says, "The human stem cell community is phenomenal here. Chemical as well as the whole number of other engineering departments have historically been very strong at UW-Madison. The combination of strength in engineering and stem cell biology was a really good fit for the work I was trying to do."

Although Kris Saha has only been at UW-Madison since the beginning of the 2012 school year, he is already looking for ways to make an impact with high hopes for his future on our campus. Admitting that curing disease is perhaps too ambitious of a goal for the first few years of a professor's work, Saha does hope to begin developing new therapeutic tools using stem cell research and aims to achieve a better understanding of disease mechanism using human disease modeling.

Saha says, "Curing disease is an ambitious goal at the very top that requires the team work which is present across the campus at UW-Madison." WE

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On the Web

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General

Supplemental Knowledge

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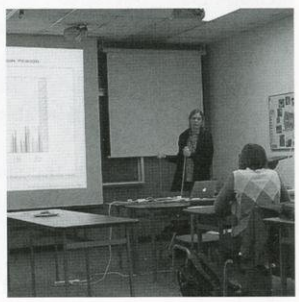

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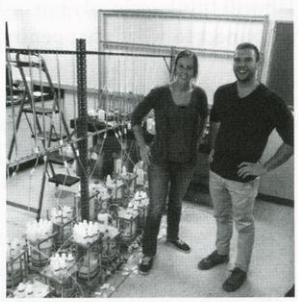

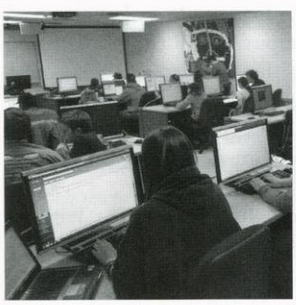

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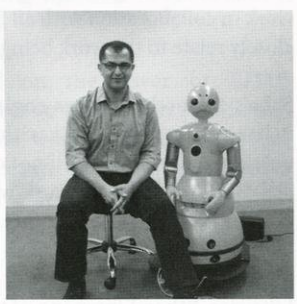

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