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wisconsin engineer

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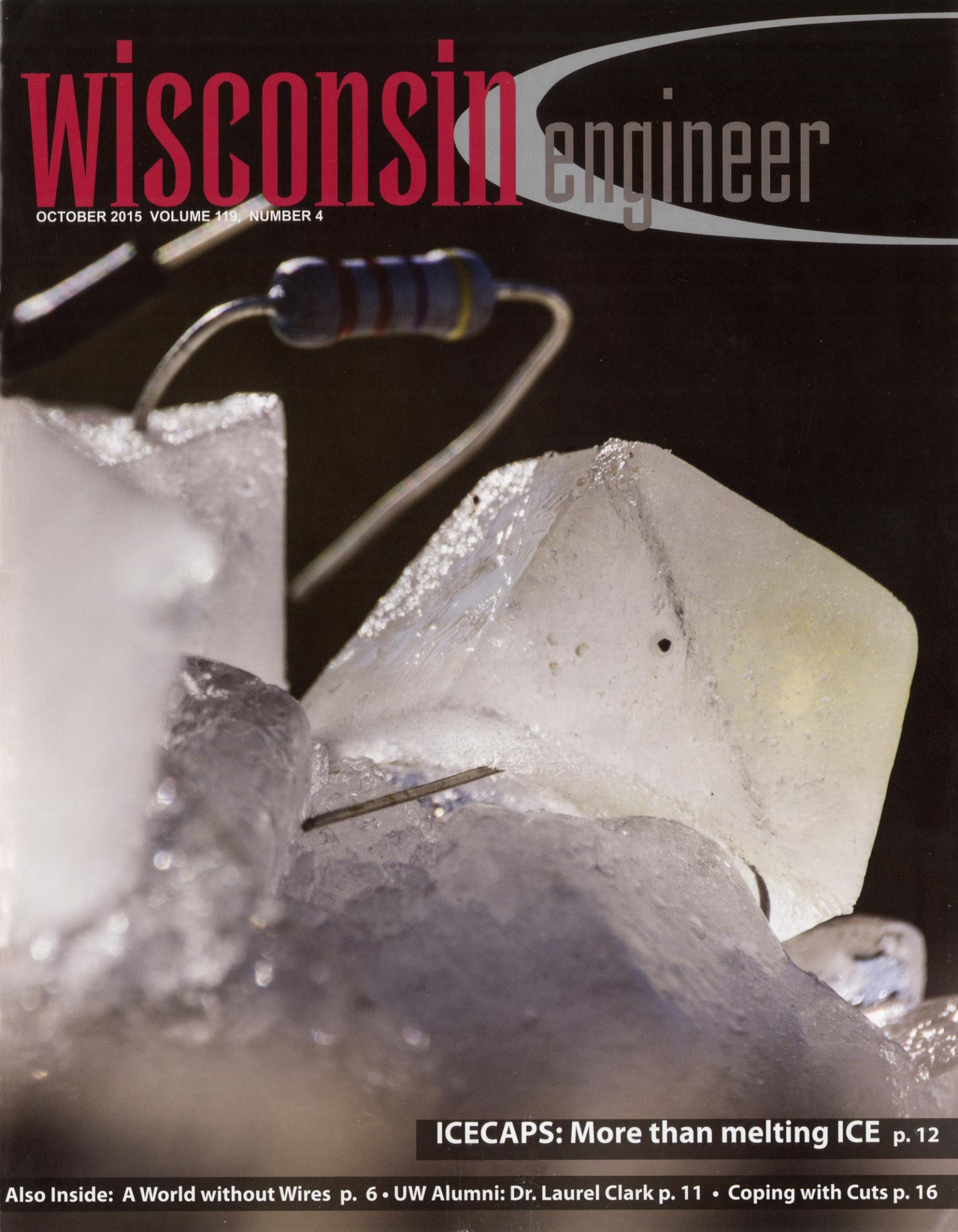

ICECAPS: More than melting ICE p. 12

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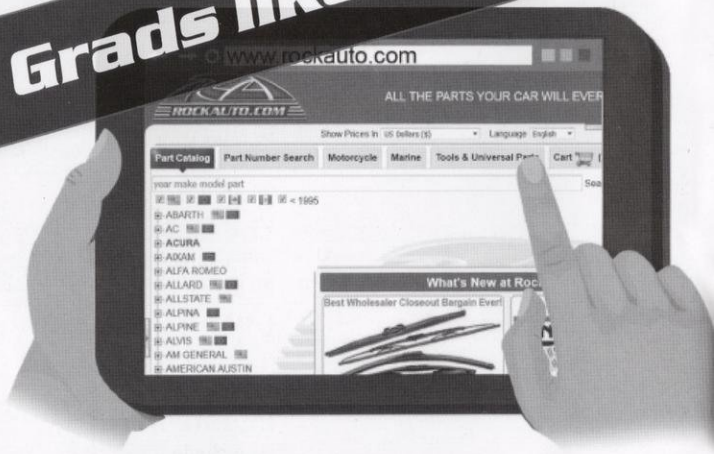

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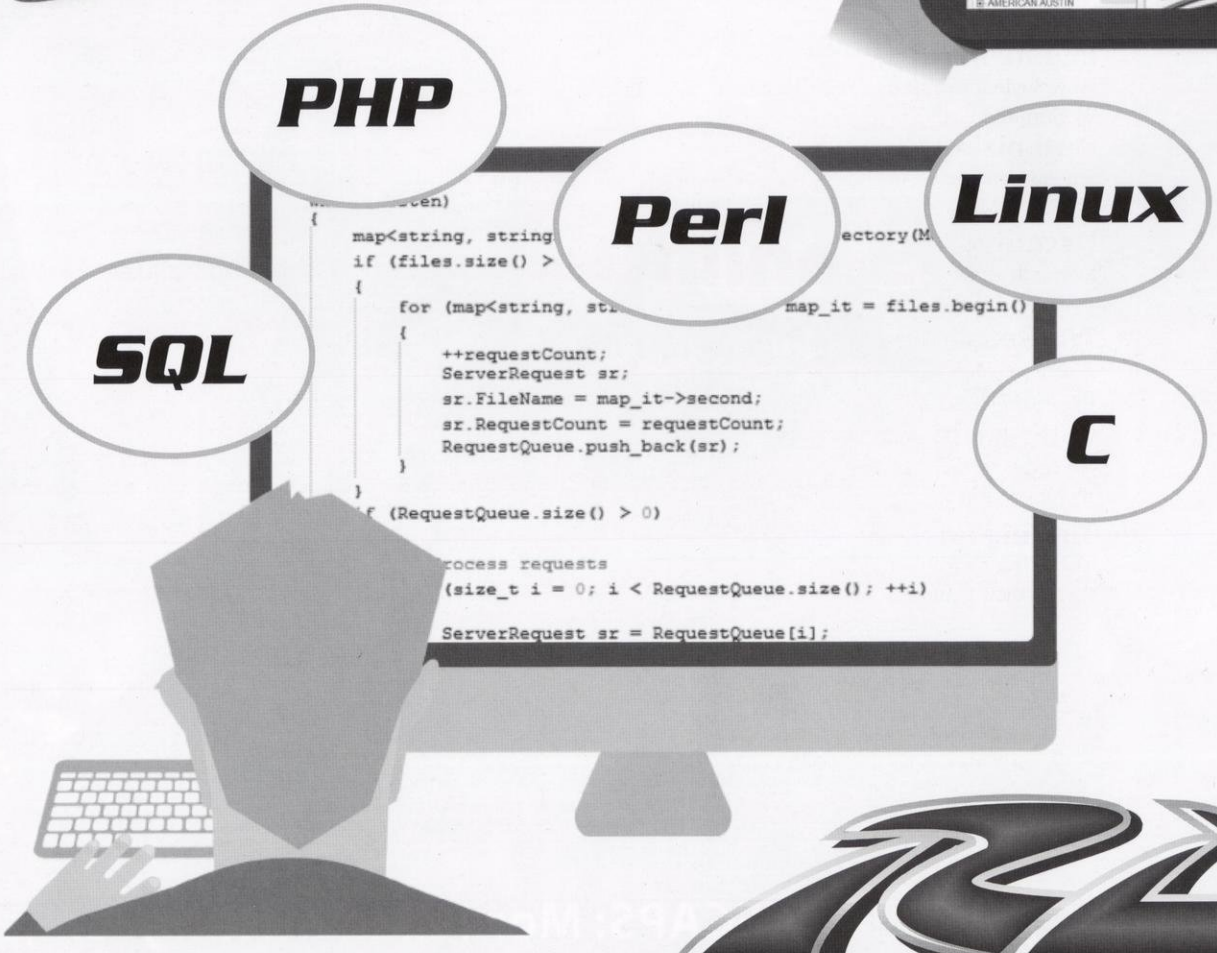

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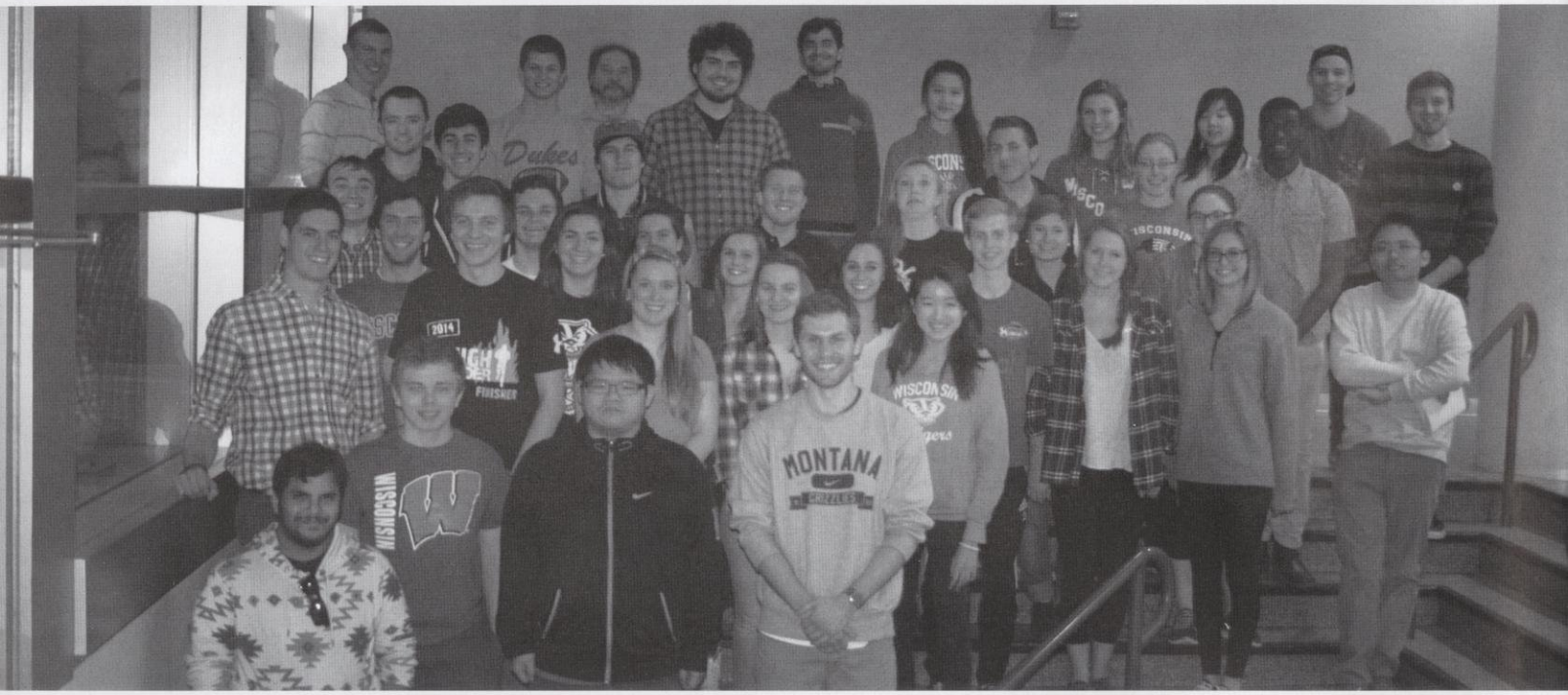
General

Various forms of sensors and technology constantly collect data for everyone to use.

Cover photo by Seth Rueter

Wisconsin Engineer Staff



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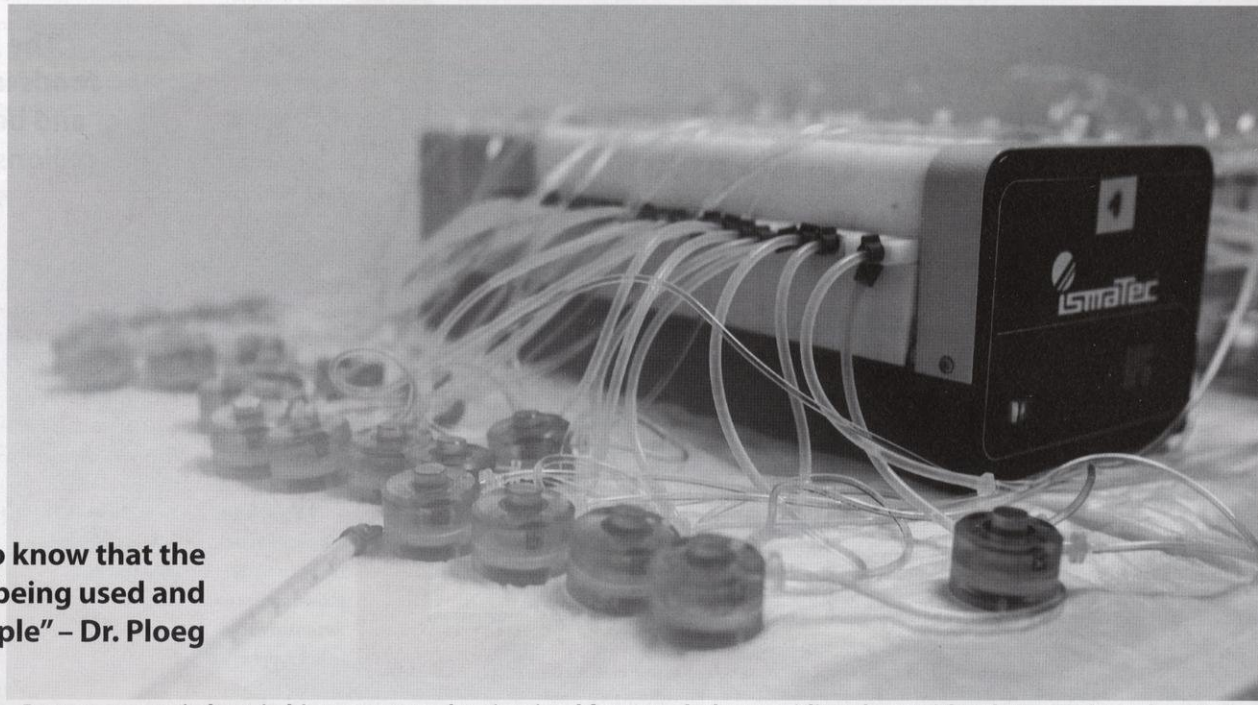
Bone and Joint Research:
Understanding the Mechanics



"It's nice to know that the research is being used and enjoyed by people" – Dr. Ploeg

Bone cores are in kept in bioreactors and maintained for 4 weeks by providing them with culture medium, keeping them sterile and at body temperature.

Dr. Heidi-Lynn Ploeg, an associate professor in UW-Madison's mechanical engineering department, is currently investigating the intricacies surrounding the human musculoskeletal system in order to allow for the development of next-generation treatments and medical devices related to bone health. After 10 years in the Swiss orthopedics industry, Ploeg decided it was time for a change and made the switch to the Bone and Joint Research Laboratory at UW-Madison. "In the industry, the research has to be oriented towards [a] product," which Ploeg says stifles creativity; "I wanted to do more explorative research on bone health."

In her research, Ploeg has generated useful computer models of bones and joints that predict mechanical behavior by simulating various situations. For example, her models can be used to determine many important properties of bone samples that are subjected to physical loads, biochemical factors or other relevant stimuli. She explains accurate experimental data is not only necessary to produce the model, but also essential when providing supporting evidence that the simulation is valid. Thus, Ploeg says she spends about 90 percent of her time doing experimental work like fatigue testing or measuring pressure distributions. However, her simulations do still make up a significant portion of her overall research.

While primarily affiliated with mechanical engineering, Ploeg also has ties with many other departments including orthopedics and biomedical engineering. These collaborations are especially critical given that Ploeg still spends time designing implants and medical devices. One of her current projects is aimed towards children who suffer from shortened or deformed limbs. The traditional medicinal approach has been to install an external frame over the patient's affected area(s), and gradually lengthen it over time. This technique involves bulky equipment that can disrupt the patient's lifestyle, which is why Ploeg is working on a more incognito design that sits under the skin but outside the bone.

Outside of orthopedics, Ploeg's biomechanics research has also been influential in the realm of sports equipment design. Citing cycling as a particular area of interest, Ploeg has worked on many products ranging from a bike's saddle to a rider's gloves. She mentions how these are exciting projects due to the relatively quick speed at which her work is incorporated into a product and sold to the public. "It's nice to know that the research is being used and enjoyed by people," says Ploeg, who goes on to explain how this fast turnaround time is possible in the sports equipment industry, but nearly non-existent for her research on bone health.

"Working with biological materials is not as straightforward," says Ploeg, "there are a lot more factors involved with the research community," such as FDA approval, that make quick turnaround times impossible. Despite this, Ploeg reasons that advancements in the understanding of bone health can have "a significant impact since it affects a greater percentage of the population," namely the elderly. Ideally, she says she would like to develop a noninvasive treatment, such as an exercise regime or pharmaceutical therapy, which promotes healthy bone growth and remodeling. With all of this research, on top of all the products she has worked on throughout her career, Ploeg has an influence that is clearly both far-reaching and influential to our everyday lives. WE

Written by: Stephen Schwartz

Photography by: Ryan Yan

Design by: Jason Wan

FindingSustainability through Diet

Exploring the shocking truths behind your dietary footprint.

FOOD	WATER TO MAKE FOOD
Chicken	518 gal/lb
Beef	1,847 gal/lb
Pork	718 gal/lb
Cheese	381 gal/lb
Rice	299 gal/lb
Pasta	222 gal/lb
Potatoes	34 gal/lb
Broccoli, Cauliflower, & Brussel Sprouts	34 gal/lb
Tomato	26 gal/lb
Eggplant	43 gal/lb
Almonds	1,929 gal/lb

In the United States, being a major player in the global economy, it's no surprise that prosperity can be found in the American kitchen. Americans spend only 6% of their average income on food while countries like Pakistan, Kenya and Azerbaijan have food budgets that can swallow nearly half of the average income. However, such a surplus in the US cannot endure the increasing global population and changing culture. Historically vegetarian countries, like India and Japan, are experiencing a cultural shift towards western habits. With the changes in these countries, as well as many others around the world, meat consumption has increased, which is shown to have grave repercussions on the environment from the resource-intensive practices meat requires. In the next decade, the earth will be home to an additional billion people; people whose need for food will increase the already grossing impact the food industry has on the environment. So the question is, how does one alleviate their impact? The simplest answer: by watching their diet.

Water is the most important resource on the planet, and unfortunately, it's in low supply: only one percent of freshwater is accessible for direct human use. Animal farming is a resource intensive practice, since water is used twice over with this food source; both in the watering of the animal and in the watering of crops for animal feed (see table). Globally, water is a precious and sometimes scarce resource, but even the United States has water problems. As California falls into the worst drought in its history, a national water crisis appears to be imminent. CNN reported that at least 40 states will feel the water pinch in the next decade because of the drought. With all these water problems, it doesn't come as a surprise that California has the fifth largest cattle population in the United States and produces 80 percent of the world's supply of almonds; two of the most water intensive foods. California has urged its residents to take shorter showers and refrain from watering their lawns, but the two-thirds of the water footprint made by people are in the foods they eat. As seen in California, it's clear that the resource intensive industries, such as the beef industry, as they stand, cannot be sustainable options as they continue to hurt the state. What would happen to the Wisconsin meat and dairy industry if Lake Michigan's water were rationed to account for the water shortages in other parts of the country? A shift to a more sustainable, vegetable-based lifestyle could be implemented slowly but immediately to keep from an economic meltdown and to keep from running out of water, before it's too late.

"The most water intensive foods in the US are almonds and beef, with nearly 2,000 gallons of water required to make a single pound."

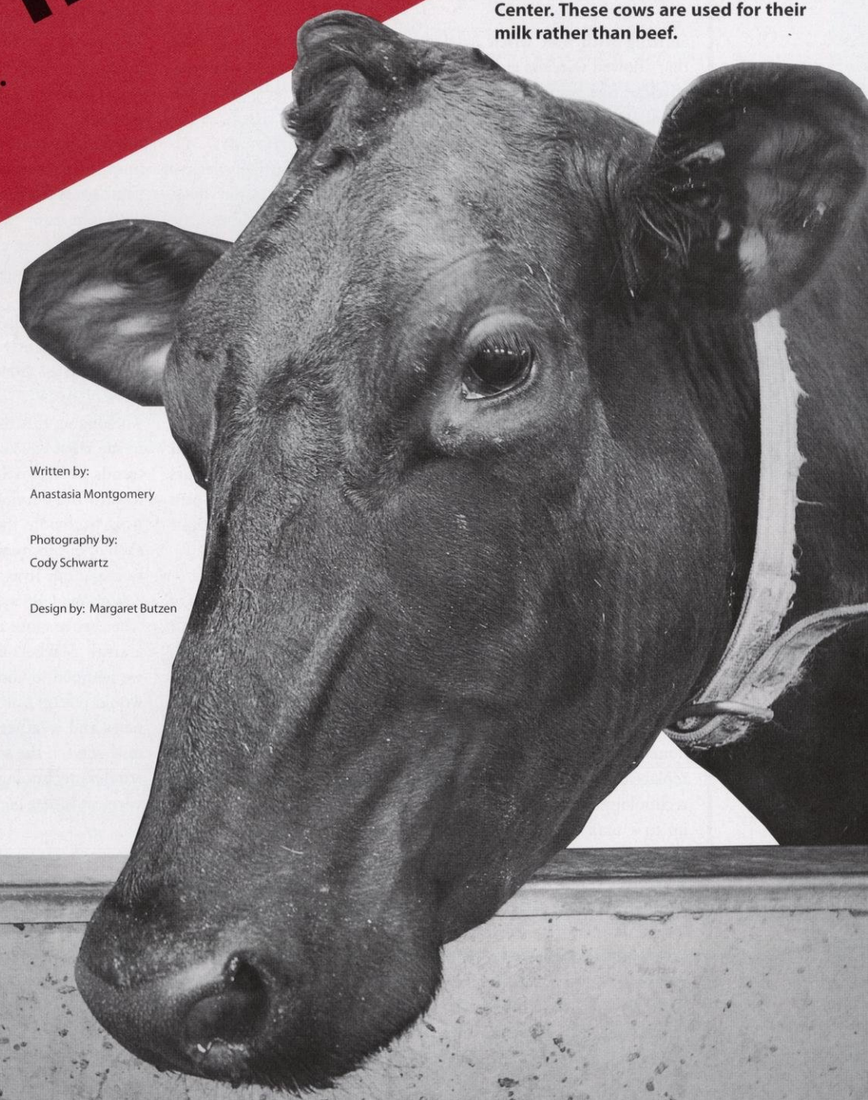
Beyond its exorbitant water use, even more environmental damage is caused by the meat industry through their emissions. Agricultural emissions outweigh all transportation emissions, which include emissions from all automobiles, trains and planes combined, with much of the pollution coming from the livestock industry. A movement for alternative fuels has been aggressively pursued in the United States, but the massive agricultural emissions proves that transportation is not the only industry affecting the world; food choices also play an important role.

When analyzing the average American diet of 2,600 calories, the average American's diet generates 2.5 tons of CO_2 emissions per year, while a comparable vegetarian diet creates only 1.7 tons of CO_2 emissions. The difference between these two diets is found by simply switching out the meat with grains, cereals and vegetables, resulting in almost one ton of CO_2 emissions difference, only by a one-person switch.

In investigating sustainability, it's clear the environment's future is connected to the future of animal farming and meat consumption. But even the species sustainability can be addressed with a vegetarian diet. Due to population increases, and subsequently rising water consumption, by 2050, water and consequently food will be scarce resources. One hectare of land for rice or potatoes can feed 19-22 people. Comparatively, that land would only feed 1-2 people if used for sheep or cows. With the population increasing and resources decreasing, the challenge becomes containing food prices that threaten starvation to millions who can't afford food. Currently, if the grains fed to livestock were instead fed to people, and additional 800 million people could be fed. Not only does a vegetated diet provide an environmentally sustainable alternative to nutrition, but a solution to feeding the increasing population.

Clearly, the easiest step to preventing drought, poverty and emissions is to shift to the more sustainable diet: vegetarianism. As citizens of one of the richest countries in the world, Americans have a plethora of options regarding their diets. Sometimes eating can be as mindless as breathing, but if we think before we eat and consider our foods' environmental impacts, the world will benefit tremendously and fewer tummies will be grumbling in hunger.

WE



Cows from UW Madison's Dairy Cattle Center. These cows are used for their milk rather than beef.

Written by:
Anastasia Montgomery

Photography by:
Cody Schwartz

Design by: Margaret Butzen

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A World without Wires

A breakdown of wireless technology, where it came from, what it's doing today, and where it might be headed.

Imagine a world in which to transmit any form of information from one point on Earth to another, whether to the house next door or to a different continent, this information needed to be passed from one person to another with some sort of physical contact. Methods of transmission might include by word-of-mouth, written down and physically transported, or more recently; slowly and painstakingly transmitted over an extensive wire network system that was often unreliable and limited in distance. Does this sound like the distant past to you? For most, it might, because not one person alive today has lived in a world where some form of wireless technology didn't exist. However, in the scope of human history, the wireless transmission of information has only been around for the blink of an eye.

Starting with first wireless telegraph system developed in 1896 that allowed wireless communication across the English Channel, wireless technology has made monumental progress. From the installation of the first radiotelephone service in St. Louis in the 1950's to today's cell phones, GPS systems, smart sensors, Wi-Fi internet, and most importantly-- Netflix streaming; wireless technology invades almost every aspect of our day to day lives, and its impact is global. Today, it is possible to communicate with someone on the opposite side of the globe with the push of a button and you can navigate from New York to Los Angeles without ever unfolding a map. Wireless technology also works in a smaller scope as well, such as turning your TV off with a remote control instead of, perish the thought, having to get up to walk to your television, or opening your garage door without leaving your car. This technology, while often used for the sake of convenience, can also be a powerful force for good. An example of its altruistic impact could be observed after the 2010 Haitian earthquake that left thousands dead and cities destroyed. Over $35 million dollars was raised in humanitarian aid from donations through text messaging alone. It's plain to see that wireless devices and functions are present everywhere in our daily lives.

Wireless technology is mostly possible through the transmission of radio waves. Devices like cell phones and televisions transmit their information through these waves over long distances. Sometimes, information only needs to be transmitted over short distances, like from one side of the room to another. One of the today's most popular ways of short distance wireless communication is done through a system called Bluetooth. Originally designed to replace certain data transfer cables, Bluetooth is a brand of wireless technology that uses radio waves to transmit information usually up to a max distance of 50 meters. These waves operate have a frequency of 2.4-2.8 Gigahertz and are able to transmit when two Bluetooth enabled devices have connected, or "paired," with one another. By being paired with Bluetooth, wireless devices can "talk" to one another, allowing the seamless transfer of information. Some Bluetooth devices can be paired with up to seven other different devices, and use alternating-frequency technology that allows them to minimize interference between each object. Bluetooth use is especially frequent among college students. UW-Madison sophomore Eric Ottmann uses multiple Bluetooth enabled devices. "I use Bluetooth on my phone, on my computer, I have speakers that use it and I have a pair of wireless Bluetooth headphones that I wear every day when I walk to class," Based on the level of usage seen by Eric and others, it's obvious that this product has ingrained itself into many of our daily lives.

"It's not often that an industry over 110 years old continues to see innovation like wireless technology has."

Brought to the public market in 1994, Bluetooth has made huge strides in prevalence and sophistication. Now incorporated into billions of products, Bluetooth has expanded beyond wireless headsets and keyboards. Today, Bluetooth can be found in almost every new cell phone, smart TV and tablet, allowing all to be remotely controlled to send information back and forth between them at the touch of a button. Bluetooth is even being incorporated into heart rate sensors that can send calories burned and average heart beats per minute information right to your cell phone during your long run. This could make shedding that freshman fifteen a little easier. Ever-expanding into new markets, Bluetooth's impacts on today's technology is constantly increasing.

Compared to the culture of technology today, where we as a society constantly look to the next best thing, it's not often that an industry over 110 years old continues to see innovation like wireless technology has. Today we can do things that those who first started working on this technology couldn't have even imagined, so who's to say what we can expect in another 100 years? Those who study trends of technology say wireless communication is headed is toward the development of "The Internet of Things." This term is used to denote the concept of a global device connection, where each of our individual wireless devices communicates with another to make our lives easier and safer. For example, in the future our cell phone GPS systems might be able to tell devices in our house when we're close to arriving home, so they could prepare for our arrival. Maybe our oven could begin heating up for the dinner we planned to cook when we get there, or our Bluetooth speakers would put on our favorite music and our TV could have the day's news and weather reports ready for our viewing. These examples only scratch the surface of the opportunities that are available for wireless technology, and show how far we've come from a simple wireless Morse code telegraph. WE

Written by: Nate Friar

Design by: Jason Wan

ICECAPS:

More than melting ice

Expanding the understanding of ICECAPS

The term icecaps usually produces the image of a mountain of ice floating in the expanse of the Arctic Ocean, but one of these "ICECAPS" is not melting. The Integrated Characterization of Energy, Clouds, Atmospheric state and Precipitation at Summit Project, referred to as ICECAPS is a project that is expanding the Arctic Observing Network. It is dedicated to providing data for the greater scientific community to help better understand Arctic Basin climates. ICECAPS is a National Science Foundation grant project. All of the data collected from the project is available for anyone to use.

The ICECAPS project, started in 2010, is a collaboration between five major universities; University of Colorado, University of Wisconsin, University of Oklahoma, Vanderbilt University, and Washington State University. Dr. Claire Pettersen, part of the Space Science and Engineering Center at UW-Madison, has been involved with the project since 2012. "I became involved with ICECAPS because I had experience working in cold climates with an engineering background and they needed someone on short notice that could stay for three months at Summit Station," Pettersen explained. She spent six years working on projects in Antarctica. This time she was called to the other pole to fix the cloud radar machine that had broken. The instruments at Summit Station measure a range of factors involving weather, including the different aspects of clouds.

"You could build up enough electricity to fry a computer."
- Dr. Claire Pettersen

The ICECAPS site resides on the Greenland Ice Sheet (GIS), 3200 meters above the bedrock. This is the common structure for ice sheets. "The site for ICECAPS was originally used for ice coring," Pettersen described. Ice coring is the process of drilling into the ice and extracting a core. This is used to determine when freezes and melts happened and determine the history of the ice sheet by examining the different textures in the ice core.

The ICECAPS site is currently used to collect data about the atmosphere above the ice sheet. This includes the types of clouds, cloud cover, and precipitation. The data collected is used to monitor how climate change affects the Greenland Ice Sheet.

In 2012, there was unusually hot weather in the United States. This warm air traveled north, to Greenland. Because of its shape, the point of Greenland usually deflects warm air moving north but in this case the hot air made it over the point. A combination of the warm air and the perfect layer of light cloud cover caused 98% of the surface layer of the GIS to melt. The last time this had happened was 1889. This event gained a lot of press at the time and was misinterpreted that 98% of the ice sheet had melted.

"From September to May there are only four flights to Summit." Pettersen explained. Due to the extreme weather conditions in the winter months the only transportation is military planes that bring a change of personnel every three months. Because of the limited access to the rest of the world, the base is completely self-sustaining. The five-person crew keeps the base running and makes sure that data can continue to be collected for everyone to use. The scientists and engineers that reside at the site maintain the data collection equipment.

On the ice, there is a focus on safety due to factors such as climate, limited access to medical help, and static electricity. "You could build up enough electricity from the cold, dry air that you could fry your computer," says Pettersen, "Wherever we went we always had to radio so the other four people on the camp knew where we were." These measures helped keep everyone safe at Summit Station.

Started in 2010, project equipment must be maintained and kept running, even in extreme weather conditions by the few personnel that work there.

This unique project is a leading step to a deeper understanding of climate change and how each part of the world affects the other parts. The data collected at Summit will provide new insight on the extent of the impact of climate change. The icecaps may be melting but ICECAPS will continue to provide research that benefits everyone who chooses to take a look. WP

More information regarding ICECAPS can be found at http://icecaps.ssec.wisc.edu/.

Written by: Emily Morzewski

Photography by: Seth Rueter

Design by: Margaret Butzen

The Golden Age of Gaming

Video games: A waste of time or a powerful tool for learning?

Cell phones, laptops, and tablets. Take a walk around any major city in the United States and you'll struggle to find a single person who doesn't have at least one of these electronics on hand. It's impossible to open your eyes without seeing the evidence – electronic media is everywhere. In a fast-paced world where people strive to be productive and electronics are often seen as a distraction, how can electronic media play a positive role in our lives? The Games Learning Society (GLS) at UW-Madison, co-directed by Dr. Constance Steinkuehler, is conducting cutting-edge research in an effort to blend education and electronic media through a medium many adults and adolescents are familiar with: video games.

By bringing together game designers and educators, the GLS center at UW-Madison is creating video games from which players can grow intellectually. "We have scientists researching stem cells and designing video games that will allow the general public to better understand those concepts," says Steinkuehler. And the concepts taught by GLS games don't stop there; Crystals of Kaydor, released in 2013, improves a player's ability to interpret body language and other nonverbal cues from other human-like characters. Another game, Tenacity, invites players to traverse through stunning Greek and desert landscapes while performing meditative breathing exercises. Players learn how to maintain deep concentration while an increasing amount of distractions are introduced throughout the game.

Looking back on the pixelated video games of the 1990s and the stress-inducing 8-bit audio that accompanied the graphics, it's incredible that video games have evolved to a level that allows them to teach players about such complex subjects. The tech giants of the video game industry – namely Microsoft, EA, and Nintendo – paved the way for video game developers and invested in the technology to make these modern games possible. Now, with an increasing number of businesses entering the video game market each year, that same technology is becoming more accessible to game creators around the world. "Production costs are low enough that new indie game developers are emerging and creating amazing, beautiful content," says Steinkuehler.

With thousands of indie game developers fighting for top ratings on their games in the various mobile app and computer gaming stores, games are being released with new innovative ideas that would have been impossible just a decade ago. "We're on the precedence of a golden age in gaming. There are game developers right now creating games that you wouldn't even imagine," says Steinkuehler. While some of the largest video game franchises are sports games like FIFA, a soccer game, or Madden, a football game, these new game developers are creating sophisticated games that have emotionally captivating content and teach players about subjects ranging from history and war to mental health and physical fitness.

The incentive for game developers isn't just restricted to high ratings; in fact, many developers are instead focusing on seeing their games positively affect the lives of their players. "Video games are now an acceptable medium for creating social change and improving the outcomes from those movements across the nation," says Steinkuehler. With physically interactive games like Dance Dance Revolution and consoles like Wii U and Xbox Kinect that cater to interactive games, children are being inspired to get off the couch. "If video games can get kids to move around and even go outside, childhood obesity in the United States could decrease by 10% and the health benefits would be tremendous," says Steinkuehler.

As video games become increasingly prevalent with the abundance of electronics following us through our daily lives, many people are cautious to accept that the games could have a positive impact on people's lives. Like other forms of media: books, movies, and TV shows; there are some video games that are too violent for some demographics and there are some that are created with no educational value at all. However, new educational and innovative games are being released every day that are revolutionizing the idea of electronic gaming, and developers will always be working to improve upon them in future games. Steinkuehler states, "The old stereotype labeled video games as a 'waste of time,' but over the years video games have grown to become cognitively stimulating and intellectually sophisticated forms of art."

Written by: Jon Smet

Photography by: Robin Ritchey

Design by: Brent Grimm

"There are game developers right now creating games that you wouldn't even imagine."

UW Alumni: Dr. Laurel Clark

Space is one of the biggest mysteries to both young and experienced minds. As children, we think of space as a vast and infinite; home to planets, stars, other celestial bodies, and green, many-eyed aliens living out there somewhere. As we get older, there are few who think further of this realm of science or how it affects life, as we know it, and are a part of research. There are even fewer who get the opportunity to research the effects practically in space, which for a lot of us is indeed the ultimate adventure. But UW-Madison alum, Dr. Laurel Clark, medical doctor, US Navy Captain, NASA Astronaut and a mission specialist aboard Columbia STS 107, was afforded this opportunity. Even though she passed away on Feb 1, 2003, she lives on in her contributions to scientific research.

To minds firmly planted on earth, it is most intriguing to know how the journey to becoming an astronaut occurs. Is it simply a very serious childhood dream to grow up and be an astronaut and push the boundaries of science in space, or does it happen by chance? "I can't think of anything specific growing up that pointed me toward NASA at all. I was interested in the Moon landings, just about the same as everyone else of my generation. But I never really thought about being an astronaut or working in space myself", was Dr. Clark's honest reply [1]. She joined UW-Madison to pursue a bachelor's degree in Science, majoring in Zoology. She had a deep interest in medicine and went on to complete her Ph.D. in medicine after graduation. While most people end up searching for good hospitals to start practicing, Dr. Clark spent time doing active duty training with the diving medicine department and continued on with post graduate medical studies in Pediatrics at the National Naval Medical Center. After a few years of training and assignments, she was designated as a Naval Submarine Medical Officer. However, she did not stop there and went on to complete six months of aeromedical training at the Naval Aerospace Medical Institute, and was designated as a Naval Flight Surgeon. Clark made several deployments practicing medicine in the harshest environments and won the Marine Attack Squadron of the Year award. It was then that NASA selected her as a mission specialist.

At every point in her life, Dr. Clark chose to make choices that seemingly not only guaranteed a much harder life, but also were rather unorthodox. It is human nature to do things that are considered safe. Dr. Clark shared a rather different opinion, "There's a lot of different things that we do during life that could personally harm us and I choose not to stop doing those things" [2]. She was immensely interested in research on life sciences and believed that it could be done on many platforms. She was very interested in the effect of zero gravity in space on different processes and how it forces changes in us as humans. Gravity is one of the variables in a lot of scientific processes and if it could be removed, one could hope to understand all the other processes going on. Her focus lay on studying these processes through gardening in space, the essence of the research that she went on to do aboard the Columbia STS 107. Being able to represent her country in carrying out the research of scientists from all around the world was one of the best experiences of her life.

Looking back at her time in Madison, she said, "I have incredibly fond memories of the eight years I spent at UW-Madison. It's a beautiful place, with four seasons up in Wisconsin and really wonderful people" [3]. She was a member of the Gamma Phi Beta sorority during her time here. The university has set up a fund in her honor to award a scholarship to a Science student every year and offered a full scholarship to her son, should he choose to attend UW-Madison. The alum has an asteroid, a crater on the Moon and a hill on Mars named after her.

STS 107 was the adventurous scientist's last mission - the space shuttle disintegrated 16 minutes before scheduled landing, taking the lives of all the seven crew members aboard. The 16-day flight was dedicated to science and research and the crew successfully completed 80 experiments on board. In her own words, "Life continues in a lot of places and life is a magical thing" [4].

"I can't think of anything specific growing up that pointed me toward NASA at all. I was interested in the Moon landings just about the same as everyone else of my generation. But I never really thought about being an astronaut or working in space myself"
- Dr. Laurel Clark

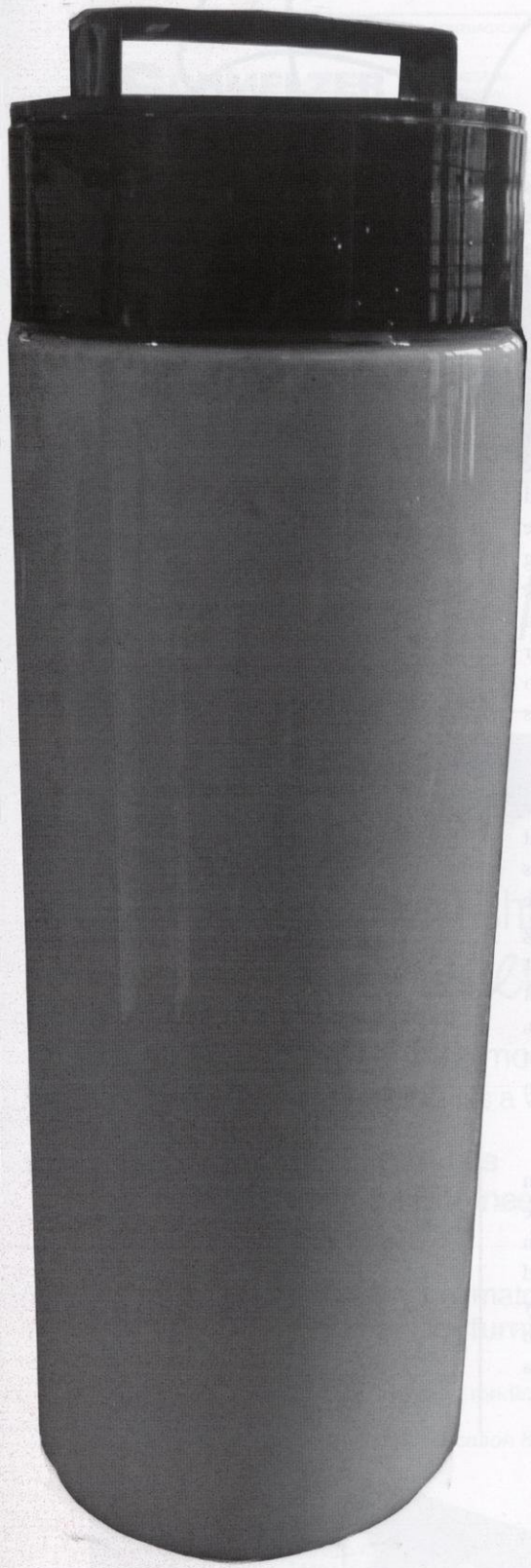
Written by: Yaman Sangar

Design by: Jason Wan

[1][3][4] http://spaceflight.nasa.gov/shuttle/archives/sts-107/memorial/clark.html
[2] http://www.foxnews.com/story/2003/02/01/bio-shuttle-columbia-physician-cmdr-dr-laurel-clark/
[4] http://www.space.com/19468-shuttle-columbia-final-flight-sts107-small-miracles.html

Engineering our Diet

How Soylent spawned a revolution of amateur food scientists



Interest in the nutritional content of food is arguably at an all time high. Websites and apps aiming to promote wellness have nutrient tracking with massive databases of food nutritional facts. Even so, finding the right balance of food to give exact proportions of nutrients such as protein, fat, and vitamins is virtually impossible to achieve every day.

Rob Rhinehart, a software engineer having trouble coping with the complications of healthy eating, decided to take a scientific and systematic approach to feeding the body. After identifying the nutrients that are essential to the human diet, Rhinehart determined the quantities of each that are necessary for humans to achieve optimal daily function and found powdered ingredients to mix into the perfect ratio. This blend of flours, starches, oils and multivitamins became the very first batch of Soylent. Since then Soylent has been edited four times, with each new batch being summarized in a "changelog," reminding users that Soylent is a feat of engineering as much as it is a package of food.

With its relatively bland but surprisingly filling nature, Soylent quickly became wildly popular on Internet forums. Some people were interested in using it to guarantee a healthy diet, while others found the convenience of mixing powder with water for a complete meal appealing for their busy lifestyles. For many people, Soylent was perfect for a few meals a week or for complete meal replacement, but two major problems arose. Firstly, Soylent was not nearly capable of keeping up with demand. Secondly, every person has different nutritional needs, and Rhinehart's perfect meal was not necessarily the right choice for everyone.

Out of this need arose a new community of amateur food scientists. In the spirit of innovation, Soylent hosts a DIY website where anyone can create, share, review and recreate recipes made by their fellow enthusiasts. While there are those who make their own meals from the recipes, other community members have started businesses to conveniently package and sell some of their own concoctions. One of the more popular creators, commonly referred to by his username "axcho," runs Super Body Fuel.com to sell his signature product, Schmoylent.

Alex Cho Snyder is a software engineer who became fascinated by the emergence of Soylent, but had interest in designing his own recipes. He designed Schmoylent to be an alternative to Soylent and quit his job with a popular video game company to sell his product full time. axcho caters to customers who desire a more customized meal replacement. On his website, he sells eight types of powdered food, including high protein, ketogenic, and gluten free varieties. For each product there is also a choice of flavor, something that Soylent does not offer. axcho also offers to custom make batches for those who need products he doesn't create in bulk, and he attributes much of his popularity to his attention to customer need. Like Rhinehart, axcho considers himself not much of a chef but more so an engineer, and admittedly, a factory line worker during long days creating product.

"There is no reason why [powdered food] wouldn't be a household staple" - axcho

I decided to give the partially liquid diet a try for the sake of this article. Schmoylent is far more flavorful than its bland competitor, and I have noticed that over time the body begins to crave it. axcho attributes this effect to the human body's response to eating something so complete and nutritious. While peculiar, the craving keeps me coming back for more, even when I think I want to eat a sandwich instead.

axcho is not sure how long he will continue to run his website, but he thinks this new interest in powdered food will only increase in popularity. He says that he sees "no reason why it wouldn't be a household staple" in the coming years. In terms of my own experience, powdered food is something that is incredibly quick to make and with such long shelf life, I would strongly consider having a few days worth at all times in my pantry.

Whether or not people are willing to give up a few solid meals a week in favor of a liquid diet is something that has yet to be determined on a large scale. What is known is that for many people, including myself, this new revolution in food engineering is making a serious impact on how their diets and lifestyles are structured. WE

Learn more at Superbodyfuel.com

Written by: Brandon Grill

Photography by: Shu Pan

Design by: Jason Wan

Optimizing the ER

First-Place finishing team of FlexSim Healthcare Student Simulation Competition.

Let's face it. A visit to the emergency room is never a fun experience. When you are scared and in pain, the last thing you want to do is sit in the waiting room without receiving treatment. Unfortunately, many American emergency rooms have waiting times upwards of half an hour. That is the situation UW-Madison engineering students Erkin Otles, April Soler, Sam Schmitt and Mike Russo addressed as they completed their project for the FlexSim Healthcare Student Simulation Competition.

The international competition required student teams to develop a simulation of an emergency department based on a case study of a Pennsylvania hospital. "They were looking to improve the operations of the emergency department," says Schmitt, a senior in Industrial Engineering. Patients seeking treatment at the hospital were experiencing long wait times. To ensure that the ill and injured were able to receive the attention they needed, it was necessary for the hospital to shorten the amount of time patients spent sitting in the waiting room. By creating an accurate simulation of the department, engineering teams would be able to locate problems that increased wait time, giving the hospital the chance to eliminate those problems. The UW-Madison team received this assignment in October of 2014 and was required to have their simulation completed before finals of that same semester, only a two-month timeframe.

The group did not let the tight schedule intimidate them. Instead, they took advantage of all the resources available. After reviewing the case study and about 25 relevant research papers, they visited UW-Health to gather more data about patient trends and hospital operations. "We looked at the number of patients the UW emergency department sees over the course of a day… and then we used some of the specific processing time data," says Schmitt. The average amount of time it took for a nurse to room a patient was a particularly useful piece of information. Once the data was gathered, they were able to enter it into the simulation program, where they constructed a 3D model of the emergency department by uploading a current blueprint of the Pennsylvania hospital. The model used these statistics to predict problems that may arise during an average day at the hospital, allowing hospital staff to prevent situations that could lead to greater injury for patients.

Their hard work paid off. In mid-January, the team learned that they had made the final round of judging. The final round was held in Orlando, FL, where the team presented their project to a group of health, engineering and university professionals, and won the entire competition.

The team attributes its success to the user-friendliness of their presentation. "We did a really good job at… making it engaging and accessible for really anybody. We didn't go into a ton of technical detail," says Schmitt. Instead of speaking in-depth on the coding they used to make the simulation, the team focused on the attributes of the model that made it trustworthy. For example, they correlated the color of the patients' shirts with the level of hospital bed they were supposed to be in, making it easy for clinical managers to quickly spot and fix a mistake. They also made the model easy to understand by placing real-world pictures of things next to their icons in the simulation; instead of interpreting a key, for example, healthcare professionals would simply see a picture of a CT or MRI machine. "[As engineers, we sometimes] get caught up in our engineering work and forget how we're going to explain it to someone else. So we really kept that in mind," says Soler, who is currently seeking her master's degree in Industrial Engineering. Keeping the simulation realistic and useful earned the team many accolades from the judges.

According to the team members, the best reward they received was the experience they gained from the project. Unlike class assignments, where students are given all of the information they need to solve a problem, the competition left gaps in the data that the team had to address. "You don't get a task at your job you can automatically do," says Soler. Working on a real world project taught the team members how to overcome unforeseen roadblocks.

Under some of the most strenuous conditions, this team of UW-Madison engineering students was able to produce an emergency department model that allows hospital staff to quickly and safely shorten the wait time of their patients. Though sitting in an emergency room is never an enjoyable experience, thanks to the students' hard work and dedication, at least the wait may be much shorter. WE

Written by: Kelsey Murphy

Photography by: Charles Fatunbi

Design by: Jason Wan

Decoding the Student Research Experience

Research at the UW is a valuable component of the learning environment, and many students are participating in it.

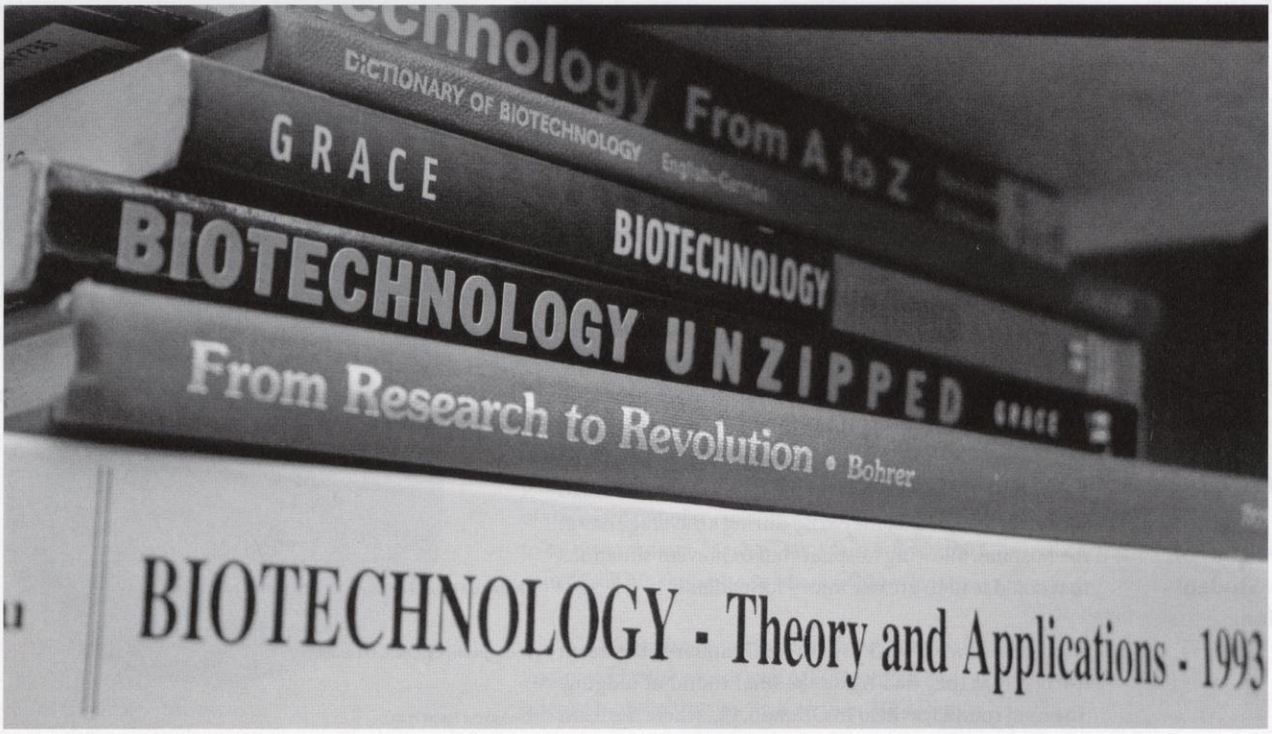
From studying the origins of the universe to using stem cells to cure diseases, UW-Madison is lauded as being one of the best research universities in the world for both the volume and intensive nature of research that is completed by professors, graduate students and undergraduate students. There is research being conducted that spans nearly every topic of interest, especially in the disciplines of science, technology, engineering, mathematics and medicine. Even though much of the academic research is managed by professors and graduate students, undergraduate students are able to access opportunities that allow them to gain unique, valuable knowledge which better prepares them for the future. Many students acquire research jobs within their first two years of attending UW-Madison and these opportunities will both complement and enhance undergraduate learning opportunities.

A sophomore studying Biomedical Engineering, Rocio Riillo, is currently involved in two research efforts; one with a sleep clinic and another at Meriter Hospital in Madison. At the sleep clinic she frequently uses electroencephalogram's (EEG's) to monitor patients' brains during their sleep cycles and has completed many overnight studies involving this type of work. When working at Meriter, Riillo works in the pre-natal lab studying the effects of dilation in uterine arteries. She commented, "These research opportunities allow me to see practical applications of what I learn in class and that's helpful." Riillo also utilizes clinical tools and instruments, such as the EEG, that she would not normally have access to if she were not involved in such inquiries. She says research also improves her problem solving and interpersonal skills when assisting patients.

Another undergraduate at UW-Madison, Luke Fowler, is a junior studying Biology with an emphasis in Neurobiology. He participates in research on Lou Gehrig's disease as well as the interaction between genetics and embryos at the Weisman Center. Fowler says that many people aren't aware of the amount of effort needed to produce a cure for a disease and his research has allowed him to see this. "Doing this sort of research gives insight into all the work that goes into finding a cure, and that's a pretty unique experience," he stated.¬¬¬ One of Fowler's goals is to attend medical school and his research work provides him with valuable experience that will undoubtedly strengthen his medical school application.

There are many ways to participate in research at UW-Madison. The research page of Student Job Center website typically contains many available opportunities for student applicants. Another approach is to contact professors that are involved in an area of research in which a student has interest to determine if an opportunity may exist. Many professors' research work is dependent upon the work of undergraduates so they are constantly looking to hire interested students. Participating in undergraduate research is a necessity for students who are looking to apply knowledge gained through course work to real life situations and to prepare for graduate school and future success.

Undergraduate research provides experience and knowledge that cannot be obtained elsewhere. As undergraduate students like Rocio Riillo and Luke Fowler prepare for their futures, the research that they have taken part in will undoubtedly help them succeed. They both agree that research is an invaluable asset to their careers and is something every undergraduate student should take part in. WE



Written by: Jacob A. Free

Photography by: Justin Williams

Design by: Jason Wan

The Roast of Engineering Hall

A satirical look at UW-Madison's Engineering Hall

While it's not nice to brag, the truth is "UW-Madison engineering" and "greatness" are synonymous to most people in the world. The engineering program consistently ranks in the top 15 universities for undergraduate studies. This success stems, in part, from the highly motivated students and professors working hard in and out of the classroom. As an added bonus, everyone can enjoy the brilliance of the campus' best-engineered piece of eye candy: Engineering Hall.

From the outside, Engineering Hall is quite the inviting building. As you approach the box-like building, you are greeted by a grand mass of metallic pillars and tall ceilings, which are surely meant to represent the high ambitions of the students attending class. A vibrant color scheme of grey and 50 shades of brick invite students to indulge in conformity and minimize the unnecessary desire for creativity. As engineering is basically just math and science, one can argue that this design is appropriate, or even revolutionary. However, any college student or basically any tasteful Homo sapien that strolls the campus may say that this building lacks a certain… well… allure? But I decided I should take a look inside before judging this book by its cover, for surely the inside must maintain the gem that attracts people from all around the world to UW-Madison's campus.

Similar to an oyster and its pearl, the inside was where the beauty resided. As I walked through a set of heavy metallic doors and into the most recently renovated area, an unsystematic area greeted me. This space consisted of a makeshift market where one can choose between two very random lunch dishes, all booths inhabited by three people (one per booth), and a couple of desks where individuals quietly type away at their laptops. So I figured, where's the centerpiece? The centerpiece being defined as a nice area to sit and socialize with one another or just a place to collect your thoughts. What beats standing around with a cup of coffee in the morning, looking through a glass window, and immediately getting inspired by the Lego replica of engineering campus! Every intricate detail up to the light saber battle atop the Engineering Research Building inspired me as I reminisced of the joy of destroying my younger brother's Lego creations and the pain of accidentally stepping on them. Also, I thought the Legos really added to what the building represents: the perfect analogy to growing up and becoming an engineering student. Engineers like myself, must continue to perfect the ability to follow directions and build things, skills vital to the future success of this planet.

After this initial glance, I began to venture into the bowels (halls) of Engineering Hall. I use the word "bowels," because I would deem the two equally pleasant to navigate. Beyond the centrally located auditoriums, the rest of the building contains a network of dead end hallways that inspire students to be as social as to ask a stranger for directions. Have to find a class on the second floor? Plan to leave at least 30 minutes earlier or else you will be finding yourself scampering through the halls constantly backtracking, wondering "Wait, haven't I already gone this way?" the whole time, as the minutes count down and your punctuality slowly diminishes.

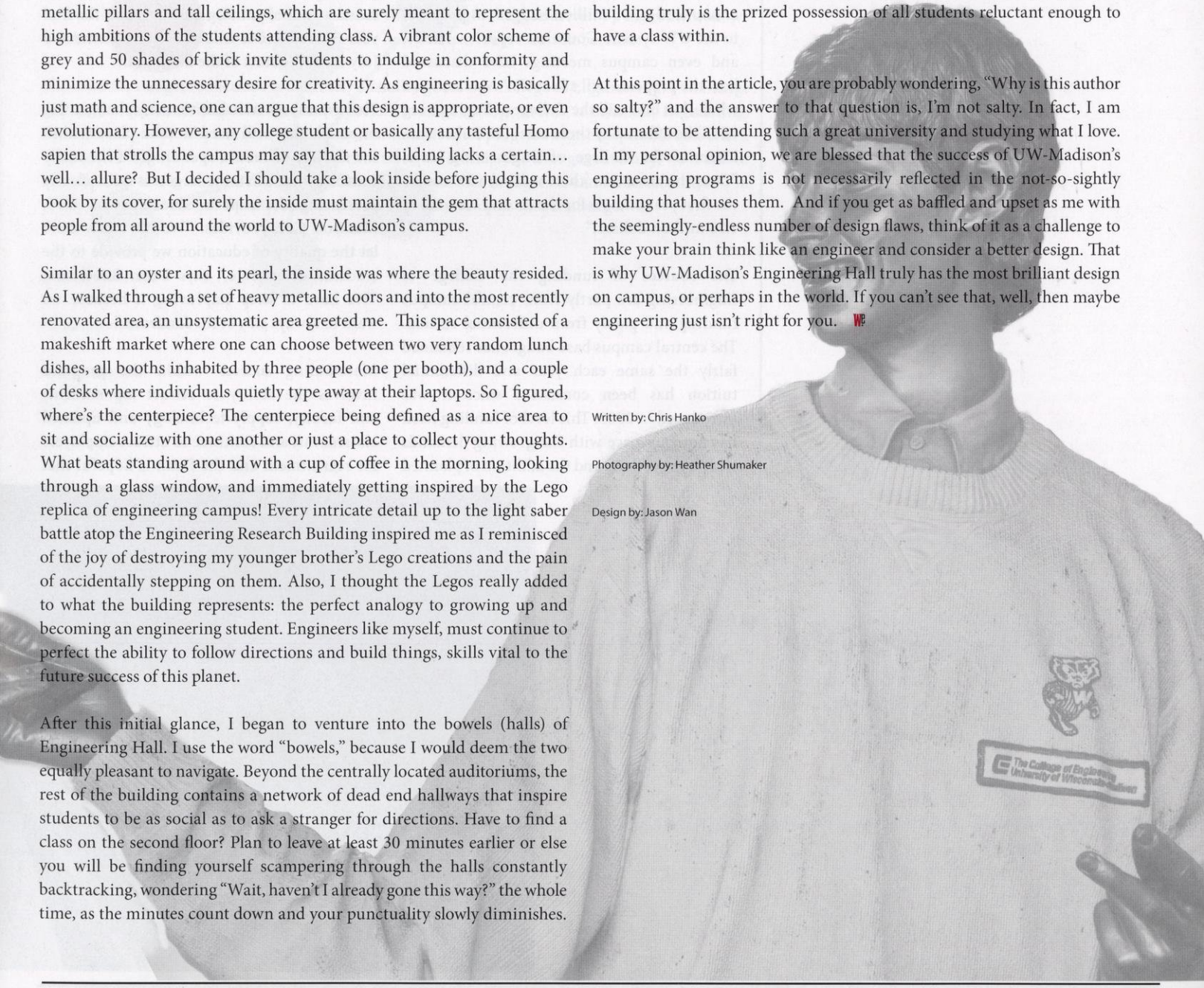
Once you have given up all hope, insult will surely be added to injury, as the class you have been seeking for so long was right in front of you the whole time. To match the navigational confusion is the equally baffling choice of abandoned-hospital-faded mint green tile that lines each hallway. Perhaps, Engineering Hall can serve a dual purpose: a premier academic building by day and a horror movie venue by night. Oh and bathrooms? Enjoy a brisk, scenic stroll through the maze to come across one bathroom conveniently located where absolutely no one would dare to venture. It remains unclear why the decision was made to paint the walls and floors yellow and to add psychiatrist couches to the bathrooms. All in all, this beautifully engineered building truly is the prized possession of all students reluctant enough to have a class within.

At this point in the article, you are probably wondering, "Why is this author so salty?" and the answer to that question is, I'm not salty. In fact, I am fortunate to be attending such a great university and studying what I love. In my personal opinion, we are blessed that the success of UW-Madison's engineering programs is not necessarily reflected in the not-so-sightly building that houses them. And if you get as baffled and upset as me with the seemingly-endless number of design flaws, think of it as a challenge to make your brain think like an engineer and consider a better design. That is why UW-Madison's Engineering Hall truly has the most brilliant design on campus, or perhaps in the world. If you can't see that, well, then maybe engineering just isn't right for you. WE

Written by: Chris Hanko

Photography by: Heather Shumaker

Design by: Jason Wan



Coping with Cuts

An exclusive look on Dean Robertson's thoughts of the anticipated budget reduction and its effect on the College of Engineering

Budget cuts. These two words are enough to send chills down just about anyone's spine. When hearing the phrase, thoughts of possible layoffs and program shutdowns may torment one's brain. The cold truth is that budget reductions of any magnitude can make maintaining a world-class university a lot more difficult. Unfortunately, no one ever volunteers to have their budget cut drastically; cutbacks are not a choice, and so those that face them must learn to cope.

Wisconsin Governor Scott Walker recently announced a 300 million budget cut proposal to the UW system. Countless reports, articles, and even campus meetings have discussed how the proposal will affect UW-Madison as a whole, but how will the College of Engineering (CoE) be affected by these cuts? Ian Robertson, Dean of the College of Engineering, says, "Over the biennium [there will be] a 3% cut for the first year and 2% for the second…a total of 1.78 million dollars."

The sources of funding the College of Engineering are partly from central campus funding and partly from differential tuition. The central campus base budget has remained fairly the same each year and differential tuition has been consistent since it was introduced in 2008. This level of funding itself has not kept pace with the growing demands within the college, and the addition of planned cuts will simply increase the shortfall at hand.

Dean Robertson, along with the Associate Deans, Leadership Council and Academic Planning Council, have been developing budget reduction plans since late December to account for the shortage of funds even before Walker's proposal. "Even if Governor Walker's budget request is changed in any way, if the 300 million is decreased, the 5% [cut] to the College will still go into effect. The cuts are real and are coming… driven not by the governor's request but because we're short some 24 million" says Dean Robertson. The cuts are indeed coming quickly, since the first year 3% reduction will be fully implemented July 1st at the start of the fiscal year.

These numbers translate to many changes, big or small, that will need to take place within the College to reduce spending. Of the many concerns that exist, the largest is quite clearly preserving the superb education the UW-Madison CoE provides. "We obviously can't let the quality of education we provide to the students deteriorate," says Dean Robertson, "We have to keep improving it because we want to always stay at the forefront."

Maintaining success within the program involves the ability to attract top students and faculty, supply technology and updated classrooms, and continue to attract employers for recruitment and the Dean is hopeful that the cuts will not destroy such abilities. He says, "We'll continue to grow. We'll continue to excel in our research and our education. Long-term I don't see [the cuts] having a major impact on what we're going to do… yes we'll change, but the end goal will still be the same."

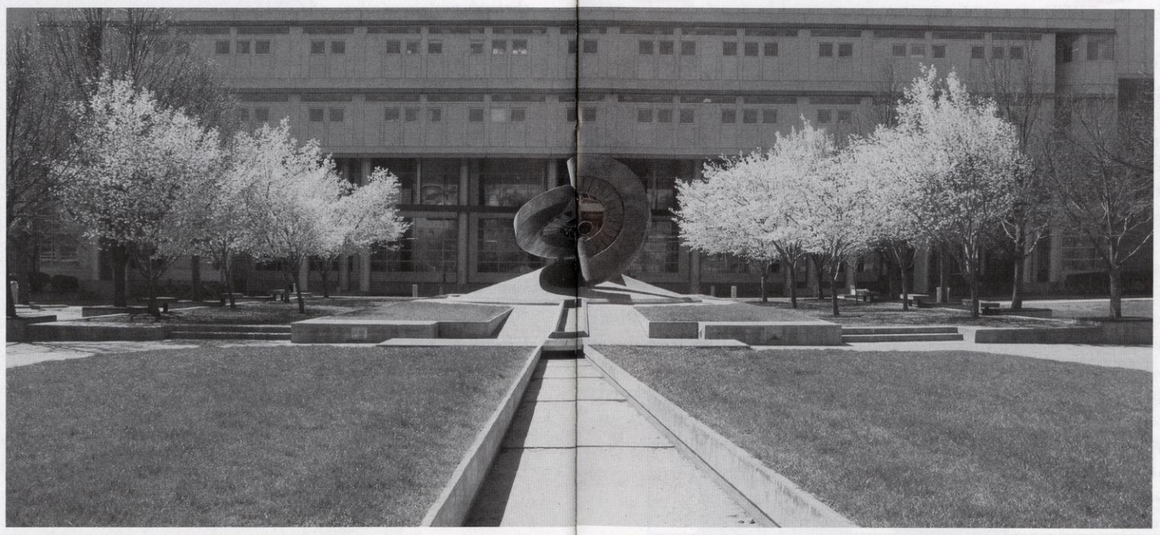
The specific areas that will face reductions are still currently being determined. It is obviously incredibly difficult to identify areas that can be reduced without concurrently reducing efficiency. "There's no program that we currently have in the College that isn't valuable. We're pretty streamlined as it is," says Dean Robertson. However, students and faculty within the College play a large part in the decision-making process. Open meetings for the student body, as well as meetings with Polygon have allowed student insight on what changes will be best for the CoE moving forward. One example of changes being discussed is to switch department admission from the current two-step process to a direct admission process. Students have also suggested decreasing the amount of computer labs on Engineering campus and instead converting to laptop-based labs. Student opinions will continue to be encouraged as these talks continue into the new biennium. "You'll find in the next year, as we implement some of these changes that are driven by the reduction, we will be engaging the students to help us decide how to do it," says Dean Robertson.

The need for budget reductions is definitely a challenge for the College of Engineering, a challenge that may require sacrifice. Change, and especially change as large as this, is definitely frightening, but students and faculty can continue to help maintain a stellar program at an exceptional university. "Our goal is always to continue improvement and so we'll make the changes carefully, we'll talk to lots of people about what we're going to do and get support for doing it," Dean Robertson says. "I'm pretty confident that our faculty, staff and students will rise up to that challenge." WE

Written by: Kelsey Bright

Photography by: Kyle Pedersen

Design by: Jason Wan



Turning Robots into Reality

Scorpio is Wisconsin Robotics' RASC-AL competition robot and was designed to remotely traverse difficult terrain and pick up specifically colored rocks.

For many families, Christmas Day is filled with food, tradition and of course, toys. From the moment that first piece of wrapping paper is torn off and tossed aside, children rush to test out their new toys. The sounds of tooting horns and revving engines fill the air as electric train sets and RC cars race around the dining room. These toys are often the first experience children have in the world of robotics, sparking an interest in engineering and robotics that some never forget. For members of Wisconsin Robotics, it seems like only yesterday.

Founded in 2002, Wisconsin Robotics is made up of 22 undergraduates and one graduate student dedicated to pursuing advanced robotics at UW-Madison. The team usually participates in one competition with both remote controlled and autonomous robots. Team members are responsible for designing, creating and testing each robot with the goal of contributing to the field of robotics and educating the public about the importance of robotics.

As the team prepares for competition, members are divided into three sub-teams mechanical, embedded and software. Members of the mechanical sub-team focus on the creation of the robot itself and ensuring the hardware is functional. When it comes to putting together the robot's electrical and processing systems, the embedded sub-team steps in. Finally, the software sub-team specializes in developing high-level runtime programs enabling the robot to send and receive data across large distances for autonomous navigation.

With all these moving parts, it is important for members to keep the rest of their team up to date. Stephen Eick, president for Wisconsin Robotics, applauded the dedication of his fellow members. "We are lucky to have such hard working team members. It is not easy to build a fully functional robot in just four months. This club is very important to all of us, and it shows in our work."

All of this hard work has led to the creation of award-winning robots, including the latest addition, Scorpio, which has the ability to pick up objects from more than 1000 miles away using a 4G-cellphone connection that allows the robot to connect to the Internet. Scorpio took 4th overall in the June 2014 RASC-AL Exploration Robo-Ops Competition.

Outside of competitions, Wisconsin Robotics actively spreads its passion for engineering and robotics to children of all ages through events such as the Engineering Expo, a bi-annual event for elementary and high school students dedicated to showcasing the unique applications of engineering topics. Previous Wisconsin Robotics exhibits at the Expo have encouraged children to get some hands-on experience with robotics through 'mini-bot' soccer brawls and even a robotics tournament for those interested in testing out their best robot designs.

In order to further increase their outreach efforts aimed at younger students, the team chose to take a break from competition following its 4th place finish with Scorpio. Instead, members traveled across the state, speaking to high school students about the opportunities in engineering and other STEM disciplines. The team also appeared at the Museum of Science and Industry's Robot Block Party, an event showcasing top robots designed by Chicago-area students and amateur teams from around the Midwest.

"It has been so rewarding to see how excited people are to learn about and interact with our robots," says Eick. "We want everyone, especially younger students, to see what is possible when you pursue engineering."

Not only did the team make it a point to showcase their accomplishments to students during their time away from competition, but they also sought to improve their designs in preparation for their toughest test yet, the University Rover Challenge. Held in the deserts of Utah this past May, the challenge invites just 22 teams from all over the world to create a remote-controlled robot capable of retrieving sub-surface soil samples from treacherous terrain among other tasks.

No matter what the outcome, Wisconsin Robotics does its best to make the most out of every competition. "All of these competitions give us great hands-on experience you can't get anywhere else," says Eick. "Not only are we setting ourselves up for future success, but we're having fun doing it too."

Although members of Wisconsin Robotics have left behind their beloved RC cars, their passion for robotics still remains, pushing them to prove to everyone just how much a little hard work and engineering can really do. WE

Written by: Matthew Latuszek

Photography by: Matt Henricks

Design by: Brent Grimm

Just One More ...
Tough Question

My girlfriend says she needs time and distance. Why is she calculating velocity?

If electricity always follows the path of least resistance, why doesn't it only strike in France?

If spiders have 8 feet why aren't they 2.43 meters long?

Why do meteors always land in craters?

How do you know if a robot has turned evil if it doesn't have red strobe lights?

If bananas have potassium, why don't potatos have banassium?

Why do people with laser hair want it removed?

If glass is made of sand, why does it taste so much like blood?

Is it pronounced "data" or "data" ?

How can math be real if our i's aren't real?

What is the square root of ANS?

If unicorns don't exist, how do we know what they look like?

How does a carbon monoxide leak sme...

Design by: Brent Grimm

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