The Wisconsin engineer. Volume 118, Number 4 October 2014

Madison, Wisconsin: Wisconsin Engineering Journal Association, [s.d.]

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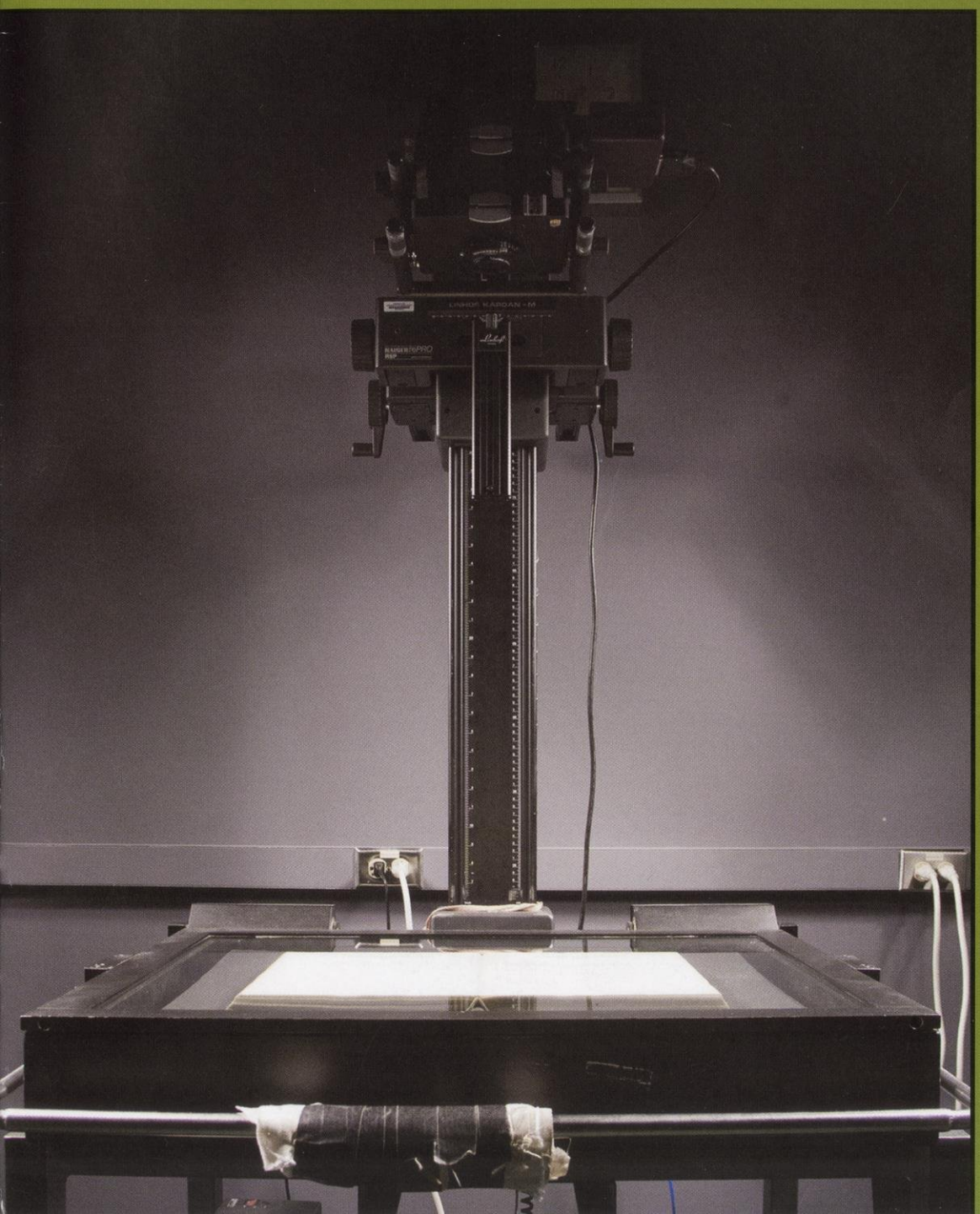
THROWBACK ISSUE

The Wisconsin

engineer



October, 2014
Volume 118, Number 4

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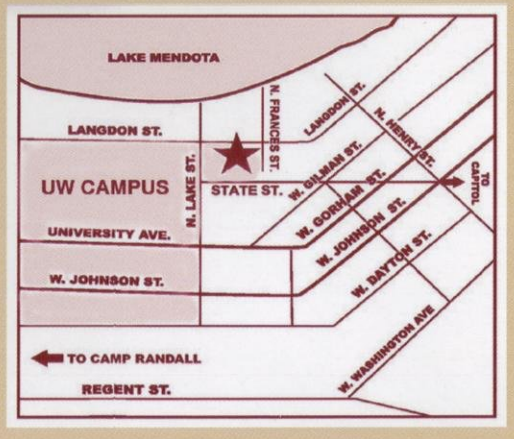

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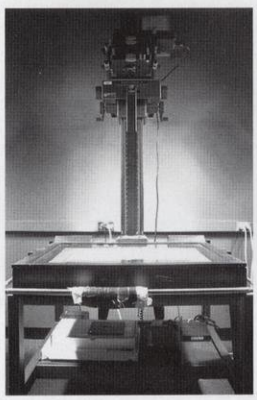
The Wisconsin engineer

Published by the students of the University of Wisconsin-Madison VOLUME 118, NUMBER 4 OCTOBER 2014

Features

General



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Cover designed after the March 1948 issue.

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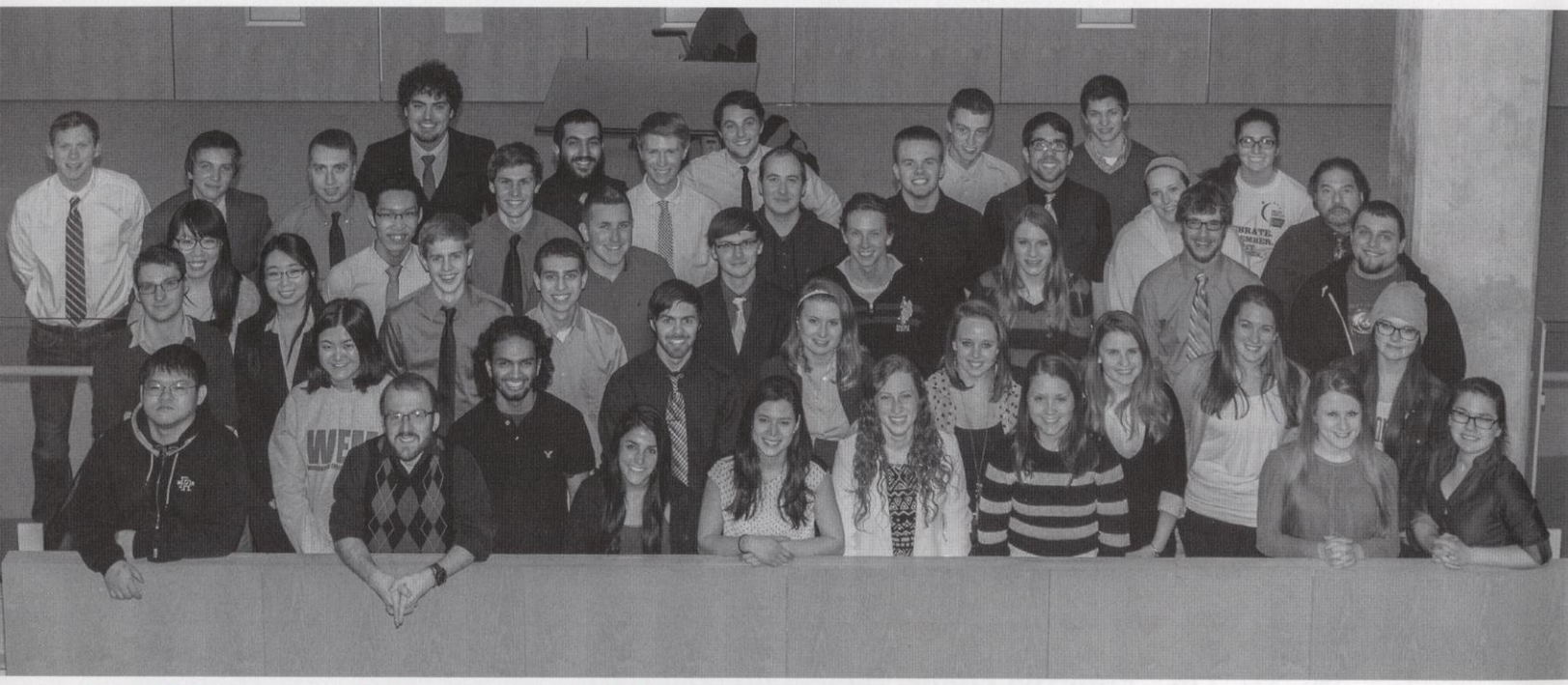

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Faculty Advisor: Steven Zwickel **Publisher:** American Printing Company, Madison, WI **Web address:** http://www.wisconsinengineer.com

Correspondence: *Wisconsin Engineer* Magazine; 1550 Engineering Drive; Madison, WI 53706 **Phone:** (608) 262-3494 **email:** wiscengr@cae.wisc.edu

The *Wisconsin Engineer* is published four times yearly in October, December, March and May by the Wisconsin Engineering Journal Association.

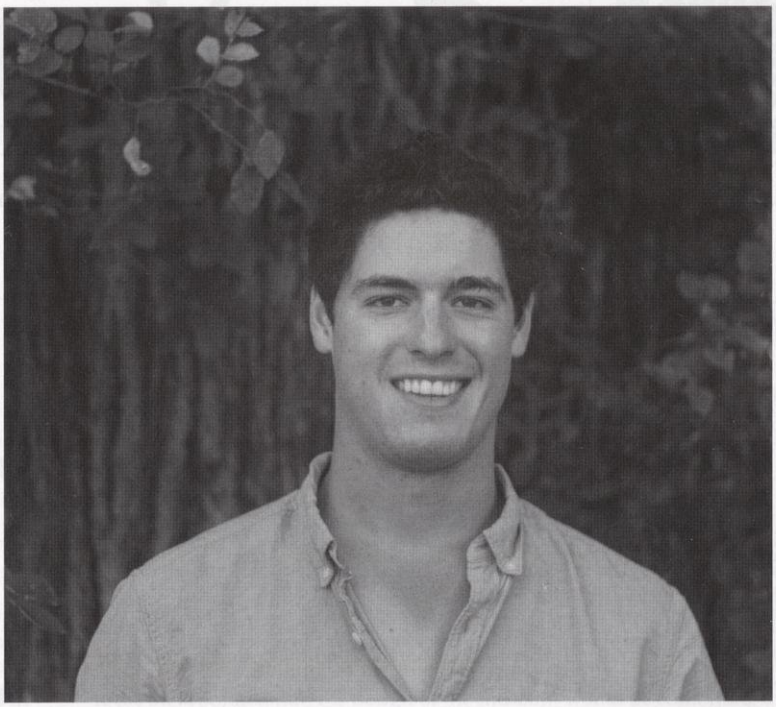
Subscription is $12 for one year.

Letter from the Editor

When I attended my first Wisconsin Engineer Magazine meeting back in spring of 2012, I truly had no idea what an impact this organization would have on my career at the University of Wisconsin-Madison. Every WEM staffer I have had the pleasure of meeting has proven to me that we here on the Wisconsin Engineer are the best and brightest that UW-Madison has to offer. I consider myself blessed to be a part of what I consider the best student organization on campus.

This issue pays tribute to all past WEM members. The Wisconsin Engineer has been in print since 1896. As you could imagine, as the times have changed so has the magazine. We have dedicated most layouts in this issue to a specific decade, mimicking the design techniques and styles that were used at that time. I hope that this can give all of our readers a glimpse into the past of the Wisconsin Engineer Magazine.

Words cannot express my gratitude to everyone who has worked on the Wisconsin Engineer throughout its history. Thank you to all past staff members, faculty advisors, and readers of the Wisconsin Engineer. None of this would be possible today without all of your hard work and dedication.



This Issue Dedicated to Gregory Clifford Noggle

Gregory Clifford Noggle, age 53, passed away on June 30, 2014. He was born in Madison on Sept. 13, 1960, to Dolores Elizabeth (Henderson) Noggle and Calvin LeRoy Noggle.

He served as a sonar technician in the Navy from 1985 until his medical discharge in 1991. After his recovery, he worked as an electronic technician, most recently at Mendota Mental Health Institute. He also continued his education, earning an associate's degree in electronics and bachelor's and master's degrees in business management.

He enjoyed travel, music, reading, hunting, dogs, bowling, swimming, art, museums, role-playing games, ham radio, astronomy, and all kinds of electronic toys. He is survived by Cathy, his wife of 20 years; his two brothers, Calvin LeRoy Noggle Jr. and Gary Ross Noggle; aunts and uncles, three nieces, a nephew, and four great-nephews.

"Greg Noggle created the first website for the Wisconsin Engineer magazine. His good cheer and positive attitude helped the magazine adapt to the coming of the electronic age. He will be missed by those of us who worked with him."

-Steven B. Zwickel
WEM Faculty Advisor

20s

Get Your Fix

The New Workplace Modeled by Pure Fix Cycling Company

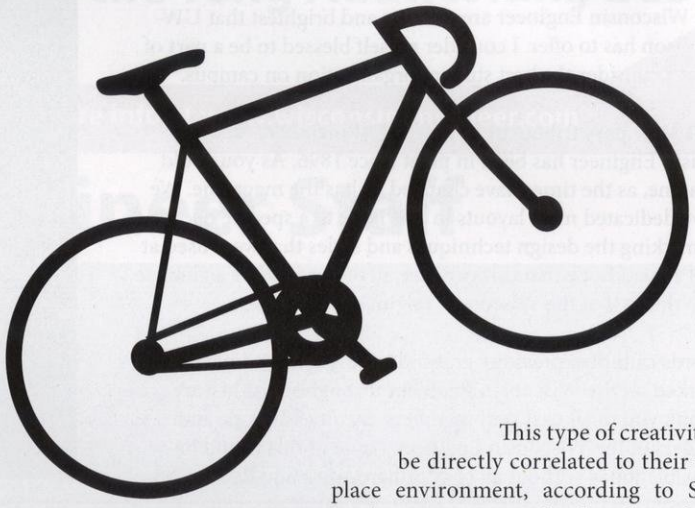
by Heather Ruhl

When it comes to new, innovative ideas, the standard nine-to-five, suit and tie job no longer applies. The usual workplace no longer cultivates the groundbreaking ideas that shape our world. Pure Fix, a company based in Burbank, CA, and co-founded by UW-Madison alumnus Zach Schau, is helping to change the way that design-based industries structure their work environment.

In 2010, a year after graduating from UW-Madison with a degree in economics, Schau and three others founded Pure Fix, a specialty bicycle design firm. The mission was to "Get as many people saddled as [we could]... we've always thought that bike riding makes you a happier person, a healthier person, and bike people are cool!" says Schau. They also have a goal to reduce the total number of cars on the road by designing bicycles that encourage people to ride to school or work.

Pure Fix specializes in the fixed gear bicycle, also known as a 'fixie'. This type of bike has one gear in front that the rider pedals, attached via bike chain to a gear that drives the rear wheel. This means that you cannot shift when going up or down a hill. This may seem like a disadvantage; however, the fixed gear style also has its advantages. The fixed gear makes the bike lighter and therefore gives it easier handling. It is also mechanically simple and efficient, making it ideal for do-it-yourself bike maintenance.

Pure Fix has taken the fixie and added multiple special design features to the bikes. Some of these features are purely aesthetic, some are functional and some are just unusual. For example, The India bike has a flip-flop hub, which allows you to ride single speed for fixed gear. A fixed gear is different from a single gear in that a single gear would allow a rider to coast; fixed gear bicycles require the rider to pedal at all times. A purchase of either the Yankee or the Uniform style bicycle means that Pure Fix will donate $100 to a water charity that focuses on water projects in third world countries. The most noticeable aesthetic modification, especially at night, comes from the Revo Juliet model. The Revo Juliet has light up tires, making the cyclist visible from all angles. The front tire is a standard white, with the rear being the standard red.



This type of creativity can be directly correlated to their workplace environment, according to Schau. Pure Fix has an open and relaxed workplace, and Schau explained that there is never a regular day at Pure Fix. They have 20-25 people currently working at the firm, with most people biking into work every day, all angling for a parking spot right next to their desk. "We're very casual," Schau says, "We promote bringing your dogs to work, and there's beer in the fridge." Pure Fix also does not regulate exact break times or work hours except in positions where it is required. The standard work attire is bike clothing or shorts and a t-shirt – not a suit and tie. Schau argues that it is this type of relaxed atmosphere that allows the team to do their best work and come up with the best designs. "If we wore suits, we wouldn't be comfortable, and if we aren't comfortable, we wouldn't be able to do our best work," Schau argues. The creative workplace approach works for Pure Fix, allowing them to do their best design and sales work.

"If we wore suits we wouldn't be comfortable, and if we aren't comfortable we wouldn't be able to do our best work"

Cutting edge technology and design cannot flourish in the regular day-to-day workplace. In order to stimulate employees' creativity, the workplace has to change. Pure Fix has built a workplace that allows employees to do their best creative work, which means doing away with the standard workday and replacing it with one that allows employees to have fun and design more effectively. WE

« MADISON MUSEUM OF SCIENCE AND BIOTECHNOLOGY »

written by BRIAN PAULUS // designed by JASON WAN

TAKE a look around Madison. What do you see? Behind the thousands of motivated college students and professors there are top of the line research labs, expressive art galleries and music venues, and massive athletic facilities. However, there is something fundamental missing from these structures that represents another central theme of UW-Madison. That essential piece is a new, innovative science museum.

Two of the driven individuals who have decided to take charge in the development of the new science museum project are Professor David Nelson and Professor Olga Trubetskoy. Professor Nelson has been teaching UW-Madison courses on the history of important scientific discoveries as well as researching in the Biochemistry department. Trubetskoy, also involved in the Biochemistry department, has taught courses on human and veterinary pharmacology and has been a part of creating programs with a focus on metabolic imprinting.

Professor Nelson was inspired to work on this museum because he was becoming more and more aware of the eloquent history that was being lost as technology rapidly advances. Throughout Nelson's teaching career he noticed that there were countless antique instruments stashed away in various buildings that had made key discoveries in the past. Watching these instruments be discarded, Professor Nelson realized that "we were losing more than just the instruments. We were losing the information about what had happened here." Since this realization he has made an effort to collect and protect these pieces of history with the hopes of one day being able to retell their stories and emphasize their significance to the public.

> *"There is a real opportunity for learning to be achieved in this museum by combing an antique instrument with a story line"*
>
> *– David Nelson*

Professor Trubetskoy, who has traveled far and wide, has always been astonished that a scientific city such as Madison does not yet have a science museum. She noted that "there are only two exhibits worldwide that have antique instruments used for biotechnology discoveries [Washington, D.C. and the UK] and Madison has even more to offer than those." Being fueled by a desire to teach others, Professor Nelson and Professor Trubetskoy have been eagerly chasing after the vision of a science museum to be a safe house for biotechnology's history.

In order to make this dream a reality there are a few obstacles which need to be overcome. Currently, the biggest challenge is finding a location for this marvelous structure. Professor Nelson and Professor Trubetskoy have been considering several potential options and are currently hoping to attain a site just off the campus, but still in the heart of the Madison community. Building a museum in Madison would be a great opportunity to strengthen the community by both celebrating and enriching the scientific scene of Madison.

However, the fact that there is no single roof for the vast collection of biotechnology has not stopped the spread of the knowledge. Professor Nelson and Professor Trubetskoy continue on with their plan to recognize the scientific history of Madison by hosting events, such as the Vitamin Discovery Story, and teaching classes about the history of important contributions in biotechnology. The course had incredible results as students were exploring the deep corners of libraries around campus for unrecognized Madison based discoveries and realizing the significance of these inventions. At every mention of the upcoming museum there is a response of support, excitement, and sometimes even the emergence of another vintage instrument that will one day be a part of the gallery.

While initially taken aback by Nelson's claim that, "It's not a monumental undertaking to complete a project like this", it is obvious that this project is more or less one building away from becoming a reality. One of the main ideas incorporated into the design of the museum would be combining an instrument with a story line. While the museum will be geared towards stimulating a higher level of thinking Professor Nelson and Professor Trubetskoy hope to make the exhibits comprehendible by all ages. The theory is that by starting with history and old technology, concepts inherently start simple. Once basic principles are explained through relics, ideas can be built upon and gradually explain more modern, intricate theories.

The anticipated layout includes exhibits that would appeal to both specialized left and right side of the brain thinkers. It would be a museum "that brings art and science together" by including expressive and interpretive visualizations of complex studies Professor Trubetskoy explains.

While there would be a large emphasis on history and past discoveries, there will also be a section dedicated to the present and to the future. This current and future portion of the exhibits opens the door for students to directly contribute to the museum by giving them the opportunity to teach others about their studies and research. There is no better way to bridge gaps in generations than by having college students reach out to both younger and older audiences through the development of science.

The primary goal of the museum is to create a public space that appeals to a large span of ages where people can go to learn as well as teach. There is a strong desire to work with UW-Madison students to find and implement new exhibits throughout the museum's life. Professor Nelson mentions that "a good museum needs live bodies as well as dead instruments and in many cases those bodies should be students". Not only do they hope to connect with the community, but they hope to continue to branch out and make strong bonds with communities abroad as well. With an extensive web of connections, there will be a much bigger bank of potential traveling exhibits to bring to Madison.

This museum would provide a common space for students and the community to collectively learn and teach about the beauties of scientific discoveries. Understanding the past is vital to exploring the future and the Madison Museum of Science and Biotechnology would create a perfect atmosphere for those thoughts to grow.

40s

Arctic Architecture

-Alyssa Hantzsch

NEXT SPRING, as the last traces of Wisconsin's seasonal tundra begin to fade away, a more permanent arctic will be coming to Madison to stay. Spring of 2015 will mark the opening of the new Arctic Passage at the Henry Vilas Zoo, an exhibit with an innovative design that will bring polar bears back to Madison.

Arctic Passage, an exhibit that will feature polar bears, grizzly bears and harbor seals, is the largest expansion of the zoo in its entire 103-year history and will house the first polar bears to be seen in Madison since the death of Mishka in May of 2013. "We're so excited to be a part of bringing the bears back to Madison," says Alison Prange, executive director of the Friends of the Zoo. "This project will make the Henry Vilas Zoo a leader in quality and care and will revitalize the zoo with exhibits that will transport our guests to the habitats of our animals." The Friends of the Zoo joined forces with Dane county to shoulder the $10.5 million cost of the new exhibit, a much-anticipated project that has been nearly eight years in the making. "These days, everyone has limited resources – government, non-profit, public, private citizen," says Dane County Executive Joe Parisi. "But when we come together we can make great things like this happen."

Leading the project is designer and architect Scott Ramser of WDM Architects, an architecture firm out of Wichita, Kansas that specializes in zoo design. WDM Architects has been working on the Arctic Passage project since its conception eight years ago. Since the firm has been in the zoo business for over twenty years, WDM Architects can be considered something of an expert in animal habitat design.

As one might expect, one of the primary goals in designing a zoo exhibit is containment – the last thing the Henry Vilas Zoo needs is a bear on the loose. To prevent any catastrophic escape scenarios, engineering analyses are run on any and all barriers that stand between the animals and the humans. "We set out to determine the maximum impact load of an animal based on its size, maximum speed of the animal, the amount of impact that would be absorbed by its soft body, and estimated area of impact," says Ramser.

However, the design of a zoo exhibit goes far beyond the task of keeping the animals contained. When it came to designing Arctic Passage, Ramser worked with the Henry Vilas Zoo to lay out three essential design goals: to attain the highest possible quality in animal welfare, guest experience and education, and facility sustainability.

"Our first and foremost priority for any exhibit is animal welfare – providing the absolute best habitat for the animals," Ramser says. To do this, the design team needs a glimpse into the animals' minds . . . or, when that isn't possible, a chat with the animals' caretakers. "We can't talk to the bears, but we can talk to the bear keepers. They're the animal professionals, the ones that understand them," says Ramser. "We work with them to create environments that are interesting, that give the bears variety and choices." The variety of the habitat is what keeps it mentally stimulating for the enclosed animals, which is not only important for the wellbeing of the animals, but also for the overall guest experience. The habitats in Arctic Passage will be made of an assortment of different materials, from wood chips to sand to grass. Fallen trees will be strewn throughout the bear yards, creating sunny and shaded areas. Keepers will have different methods of feeding the bears, whether they bury sweet potatoes in the yard for the bears to dig up or drop food into the habitat from scatter feeders at different times throughout the day.

The most exciting development for the bears is that they'll be able to experience a change of scenery on a day-to-day basis due to the habitat flexibility that has been designed into the exhibit. "We'll have two bear yards, one for the polar bears and one for the grizzlies, but we'll have the ability to put either species in either yard so they won't be in the same habitat every day," Ramser explains. When they swap yards, the bears will have new sights and experiences to keep them occupied, as well as the lingering scent of the other species to investigate.

Top Left - Groundbreaking for the new exhibit took place in March, and construction progressed throughout the summer.

Bottom Left - Harbor seals, as well as polar and grizzly bears, will make their new home in the Arctic Passage exhibit.

Right - The Arctic Passage design features two new bear yards, underwater seal viewing, and an indoor dining facility.

"That will be very enriching to the animals, as opposed to going back into the same yard day after day," says Ramser. With these features, plus the added amusement of a ten-foot deep swimming pool and a fishing stream stocked with live fish, zoo guests can look forward to seeing a lot of action in the bear yards.

One of the best places to view all the excitement will be the brand new Tundra Grill, the Henry Vilas Zoo's first-ever indoor dining facility. Zoo directors hope that this new feature will help to attract more visitors during the long Wisconsin winter. Tundra Grill is just one example of the zoo's increasing emphasis on improving the overall guest experience. Not only are they trying to create an enjoyable experience, but an educational one as well. "The guest experience portion is very important for the zoo to accomplish its mission in education and furthering conservation of polar bears and all animals," says Ramser. "We want to create an exhibit that sets the stage for the guests to really appreciate and learn about the animals." WDM Architects is working with an interpretive designer to devise an interactive, storyline-like educational component to supplement the animal exhibits. "We're trying to create a deeper understanding of the conservation need, how to help support conservation, how climate change is affecting bears, and how people are affecting climate change," Ramser says. Zoo guests of all ages will enjoy a fun and educational environment as they stroll down "Cub's Trail," watching and learning about some of the Arctic's most beloved inhabitants.

Henry Vilas Zoo isn't stopping at teaching about conservation. "We're also going to walk the walk in renewability," Parisi says. The state-of-the-art exhibit will be a 1.7-acre sprawling complex, but Ramser has designed it to be a sustainable facility by using as many green practices as possible. Solar panels will provide power to the exhibit, and natural lighting and ventilation will be put to use wherever possible. Hundreds of thousands of gallons of water will be saved each year by harvesting rainwater and recovering and reusing backwash and dump water from the two immense pools in the bear yards.

If all goes according to plan, Arctic Passage will open to the public next spring. Four of the six harbor seals are currently in residence at the Henry Vilas Zoo, and the zoo staff has already identified the two grizzly bear sisters who will be making Madison their new home. The polar bears have not yet been selected, but the zoo directors are working very closely with the Species Survival Plan to ensure that Arctic Passage will have a breeding pair of polar bears come springtime.

"One of the things I'm really proud of is that this zoo is 103 years old and we are running into our second hundred years at light speed," says Henry Vilas Zoo director Rhonda Schwetz. "We're becoming the zoo to watch in our industry, and we're doing it while we're free." As a model of exemplary animal care, public education and renewability, Arctic Passage is helping to further all the ideals that every zoo should stand for. "When you see Arctic Passage in 2015," Schwetz says, "you're going to realize that our Henry Vilas Zoo is the zoo of the future." WE

ARCTIC PASSAGE FEATURES:

New habitats for six harbor seals, two grizzly bears and two polar bears, as well as space for other animals in the future.

Indoor dining at the Tundra Grill restaurant, with a 38 foot bear-viewing window.

Interactive educational exhibits about climate change and conservation.

Sustainability components such as solar panels and rainwater harvesting.

Photography By: Abby Schaefer

Photo by Samuel Fritz

Revamping the Biomedical Engineering 201 Design Course

by Brett Adkins

In a field that evolves every year, it's appropriate that a course in that discipline would too. Dr. Amit Nimunkar, Dr. John Pucinelli and Caleb Durante, a graduate student, have been working relentlessly over the past year to revamp the biomedical engineering 201 design course in an effort to give students a more enriching and memorable experience in their first design course in the biomedical engineering program at UW-Madison. The first set of classes with the new changes began in the spring of 2014.

The purpose of the BME 201 design class is to provide biomedical engineering students with firsthand experience in taking a client-based project from conception to reality. Dr. Nimunkar says that the idea behind their applied approach is that if students get "real-life, hands-on experience building, they will be better engineers and better able to innovate and solve grand challenges." Over the past 15 years the BME design classes existed as six distinct design classes taught over six semesters. Each design class had a different area of focus such as circuits, tissues or bioinstrumentation, a branch of biomedical engineering concerned with medical instruments.

The instructors found the problem with this approach to be that many students had difficulty retaining skills learned as a sophomore and applying them to their senior year capstone projects. After consulting with student instructors and past students of the class, the team proposed a new structure for the most common first design course, BME 201. Dr. Nimunkar emphasizes that in the new BME 201 course, the students "have one semester where they teach all those skills right away," which when coupled with guided design, would allow "the students to see how all those skills come together in a meaningful way." Dr. Nimunkar believes that this approach enhances the likelihood that the students will retain this information as they move up the BME design course curriculum.

Another problem the instructors noticed was that students often lacked the technical knowledge necessary to design and fabricate many of the projects that real-world clients desired. Therefore, Dr. Nimunkar, Dr. Pucinelli and Caleb Durante decided to collaborate with the student assistants to determine a unique project that tailors to the vast range of focuses within biomedical engineering and is not too technically advanced. By doing this, the teams of students are more likely to design a fully functional finished product rather than an incomplete one.

Furthermore, because students have the opportunity to work on a project that involves biomechanics, circuitry, tissues and other biomedical fields, they learn about each specific track within biomedical engineering and can make a more informed decision as to where their interests lie.

Currently, after the revamp, the course is structured so that students spend the vast majority of class time in the lab designing and building their projects. During each lab period, the design teams apply concepts learned at the beginning of the lab period and lecture to their project. Durante emphasized that during lab there is "a lot of one-on-one interaction between the instructors and students." As the design teams progress, student assistants and the professor work alongside the teams to create an environment that exudes a strong culture of collaboration.

The most noticeable change to the BME 201 design course is the incredible facilities that have been modified to match the needs of the students.

What was previously a cluttered research lab has since been transformed into a state-of-the-art design workspace, outfitted with computers, lab benches and whiteboards.

Even with such extensive changes, Durante stresses that this class continues to evolve and that their work in revising the design curriculum is never finished. Even now, they have not completely finished renovating the lab. The team plans on turning a cluttered room in the back of the design lab into a professional workspace where biomedical engineering students from all levels can organize team meetings or meet with clients. This goes along with Dr. Nimunkar, Durante, and Dr. Pucinelli's hope to create an incubator where upper-level BME students can consult with professionals and outside investors to help turn their designs and innovations into real-world marketable products. Dr. Nimunkar stresses that it's imperative to focus not only on the technical and design side of engineering, but also the professional and entrepreneurial side.

The BME 201 design class has become much more multi-dimensional and has been completely revamped to provide students a more valuable introductory experience into the field of biomedical engineering. As the BME design courses continue to evolve, expect many changes on the horizon as the teaching team tries to stay ahead of the ever-dynamic field of biomedical engineering. WE

Left - Professor Amit Nimunkar and John Pucinelli standing in front on the new BME Design Lab.

Right -An experiment being run by undergraduates in the newly designed BME Design Lab.

Photo by Samuel Fritz

Decades of Discovery

UW-Madison's history of innovation spans three centuries and all areas of life.

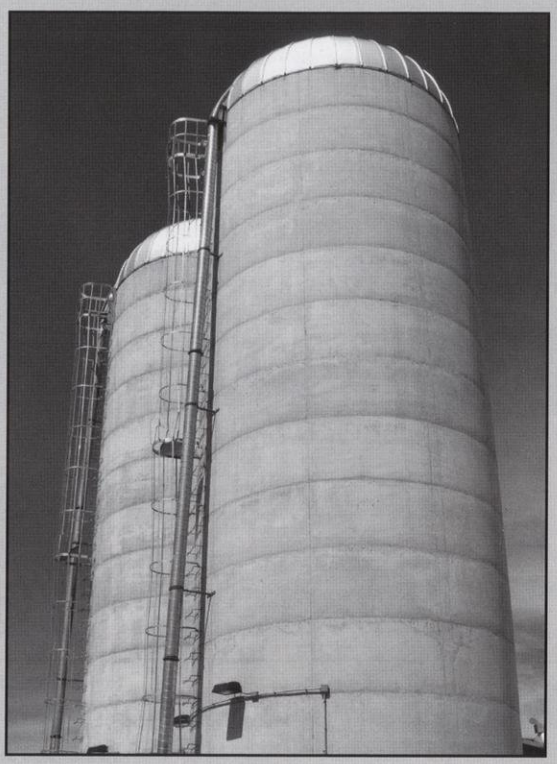
UW-Madison has a well-deserved reputation for invention. Most students are well aware of the University's work in fields such as stem cells and clean energy. However, UW-Madison has also been a major hub of innovation since its founding. Throughout UW-Madison's history, students and researchers have developed creations that have changed the courses of many fields. Here's a look at some of UW-Madison's earlier discoveries that established its reputation.

Round Silo
Agriculture

1910

The first American silos, modeled after Hungarian grain storage techniques, were simply pits dug in the ground. However, due to a combination of the less favorable climate and larger American quantities, the pit storage method was not economical. The next design attempt, that was popular in Wisconsin, was a concrete and stone construction that was square in shape, and was built in Oconomowoc in 1880 by Dr. L.W. Weeks. The square design led to other flaws, primarily the excessive pressure exerted by the silage and grain rot fostered by air pockets in the corners. In 1910, Professor F.H. King of UW-Madison developed a round silo that solved the issues of outward pressure and grain spoilage.

Wisconsin was an ideal location to develop a more efficient silo. To maximize a cow's milk production, it must be fed a specific diet composed largely of the grain stored in silos. The burgeoning dairy industry needed a way to keep cattle feed fresh for longer periods of time to facilitate a longer milking season.



Left - Professor F.H. King of UW-Madison developed a round silo that solved the issues of outward pressure and grain spoilage.

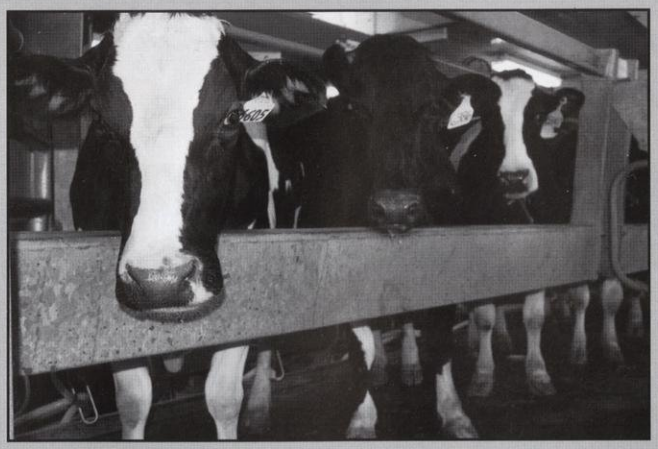
Right -A cow's main diet composed largely of the grain stored in silos

Vitamin D Irradiation
Food Science

1923

Harry Steenbock, after whom Steenbock Library is named, discovered that the vitamin D content of food could be increased by exposing the food to ultraviolet light. Wavelengths in the ultraviolet range interact with 7-dehydrocholesterol in the milk, a compound that is a precursor to vitamin D. UV light excites the 7-dehydrocholesterol molecules so that they rearrange and form vitamin D. Steenbock's primary application of vitamin D irradiation was in the dairy industry, particularly milk. Again, Wisconsin was an ideal testing ground for milk irradiation due to its thriving dairy industry.

Steenbock's work not only led to the eradication of rickets, a bone disease resulting from vitamin D deficiency, but also inspired a group of donors, helmed by Steenbock, to create a non-profit UW-Madison group to handle the legal aspects of innovation, including patenting and licensing. Steenbock directed that the group would use the profits from licensing to fund further UW-Madison research projects. This idea grew into the Wisconsin Alumni Research Foundation (WARF), and was one of the first American University-based research technology offices.



Social Security
Social Welfare
1935

Perhaps the most well-known, non-concrete creation to come out of UW-Madison is Social Security. In the throes of the Great Depression, President Roosevelt turned to Arthur Altmeyer, the assistant secretary of labor at the time, for assistance. Altmeyer, who was a Wisconsin native, nominated former UW-Madison colleague Edwin Witte (the namesake of Witte Hall) to develop a system that would provide an economic safe haven for those Americans who had been driven to near poverty. Altmeyer chose Witte because of Witte's past experience in designing an unemployment insurance plan to protect Wisconsinites who had lost their jobs.

Although Witte was confident that an insurance plan would begin to direct the attention of the public towards one of the roots of the Depression, economic insecurity, he also knew that insurance alone would not be the saving grace. Witte reasoned that if people had a financial cushion to fall back on, they would be more likely to invest and start businesses. Social Security was intended to provide that confidence, allowing Americans to branch out and jumpstart the cycling of money through the economy once again.

Witte's most significant challenge came in the perception of his efforts. Many right-leaning politicians and businessmen opposed the program on the grounds of tax increases, while some left-leaning groups, such as clergy, argued that the economy would be better served by a complete turnover to socialism. Witte clarified that his program was no more than a reinforcement of capitalism, affording people the freedom to spend as they desire rather than as they are forced. The bill ultimately passed by a wide margin, cementing Witte's place in the upper echelon of American economists.

Despite some of the recent challenges with the execution of Social Security, there is little doubt that the economic cushion it provided during the Depression helped many Americans get back on their feet.

Warfarin
Medicine
1945

In February 1993, a local farmer brought a dilemma to UW-Madison researcher Dr. Karl Paul Link. The farmer's cattle, along with that of many other farmers, had been dying of blood hemorrhaging during routine operations. The farmer presented Dr. Link with one of his bovine victims, in addition to a sample of spoiled sweet clover hay and a jar of blood from that cow. The blood was curious in that it did not coagulate as blood naturally does. At the time, Canadian veterinarian Frank Schofield had already determined that there was a connection between the damaged sweet clover hay and fatal blood loss in livestock, but the mechanism that connected the two was still unknown.

Dr. Link felt particularly inspired by the devastation he witnessed to the local cattle herds. The damage motivated Dr. Link and his student, Harold Campbell, to work with increased urgency, and after six years of research, Campbell identified and isolated dicoumarol, the substance that prevented blood coagulation. The pair discovered that dicoumarol was formed when certain plant molecules interact with fungus. Since their research was subsidized by WARF, the synthesized substance was dubbed "warfarin" and large-scale production began.

The first industrial use of warfarin was as a rat poison, for which it is still often used. Warfarin's effects are strategically not immediately apparent, preventing a collection of rat bodies near the poison source, which would likely alert a rat not to eat the bait. It was not initially used in humans, due to safety concerns. It was not until an attempted suicide by an overdose that warfarin was corrected by vitamin K supplements that the potential for human applications was explored. The human variation, marketed as Coumadin, gained widespread acceptance when it was prescribed as a part of President Eisenhower's heart attack recovery regimen. Since then, warfarin has been used to treat countless patients with excess blood clots, and has saved thousands of lives.

UW-Madison's proud tradition of innovation has changed the course of the United States. Wisconsin research has revolutionized state industry, eradicated disease, pulled the country from the midst of economic disaster, and transformed medicine. Recent UW-Madison developments include advancements in genetics, crop production, and engineering. The University's record clearly demonstrates that the innovation trend will continue, and Wisconsin will continue to contribute to the improvement of society. WE

Written By: Andrew Kerber
Photography By: Jenny Demeules

Where Did the Blackboards Go?

Five professors with a combined 214 years of teaching experience share their perspectives about how UW-Madison has changed.

By Mikaela O'Keefe

The perfect way to find out how UW-Madison has changed in the past few decades is to ask the people who have witnessed it firsthand. I had the pleasure of sitting down and interviewing five professors, both current and emeritus, in order to gain insight on how UW-Madison has changed over time. Let's meet them:

Professor Willis Tompkins

Department: ECE, Biomedical Engineering
Here since: 1974
Tompkins has taught the course 'Computers in Medicine' for 40 years… and he does a magic trick before every class period!

Professor Emeritus Stephen Robinson

Department: Computer Science, Industrial and Systems Engineering
Here since: 1972
Prior to becoming a professor, Robinson grew up in Madison. In 1958 and at the tender age of 16, he taught his first course here: the 'Numerical Analysis' lab.

Professor Michael Corradini

Department: Engineering Physics
Here since: 1981
Corradini remembers listening to a Badger game during a hiking trip even though the team was losing horribly. He insists, "The things that matter haven't really changed one bit."

Professor Emeritus Glen Myers

Department: Mechanical Engineering
Here since: 1962
Myers remembers when UW-Madison was more personal. For his interview, the department chair brought him home to meet his family.

Professor Emeritus John Uicker

Department: Mechanical Engineering
Here since: 1967
Uicker, who came to UW-Madison after a deployment, remembers that students' primary department, expanding it from one computer to several different labs -- CAE East and CAE West.

On School Spirit...

Today, we say that we will be 'Red till we're dead," but has it always been that way? Yes. Badger spirit has been constant throughout the ages, even though the success of our sports teams has varied. The Badger football team didn't win a single game in 1967 or 1968, the '70s were rough, and from 1986 to 1990 the Badgers won a total of nine games. Tompkins chuckles, "When I first came here, you could walk over to the stadium and right into the game. If it was past half time, you didn't even need to buy a ticket. Now you have to 'grease the skids' and give some money to the Foundation before you can even get a season ticket." Despite all this, Robinson says that "student support for the teams was just as intense 50 years ago as it is now." Corradini confirms this and says, "We were losers in those days, but we still had spirit. Winning doesn't make spirit; it's the identification with the institution."

On Technology...

The technology available now is a vast improvement from what was available 50 years ago. Robinson says that "the way students learn and organize their lives is completely different."

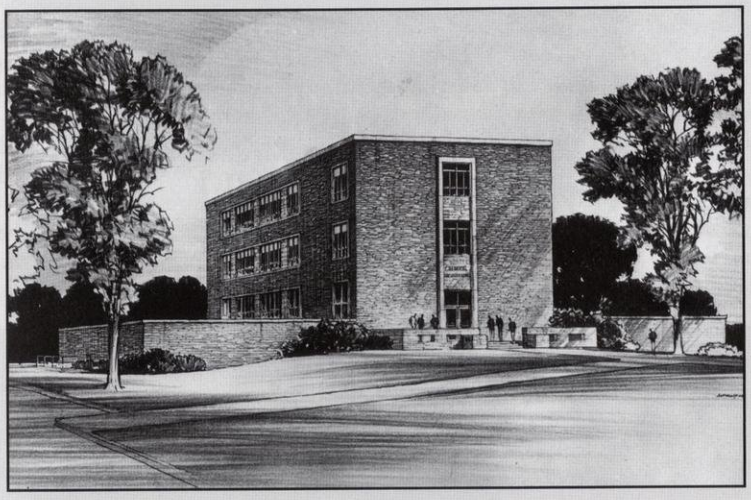
Back when these professors first started, there was one computer that served the college. "You programmed by punching holes into cards; each card had an individual instruction. Students and professors alike would walk around campus with a deck of cards. You had to be careful, too- definitely didn't want to drop them," Tompkins explains. Corradini says that "calculations I now do on my laptop used to require walking all the way over to Do-It with my deck of cards and waiting for a print out." Robinson sums it up: "The presence of computers has drastically changed the way we teach, research and our actual curriculum "

On Structural Changes...

The most obvious aspect of UW-Madison and the College of Engineering that has changed is the architecture; a majority of the buildings have been either built or renovated in the past 50 years. Where the Engineering Centers Building now stands, there used to be a series of temporary buildings. Tompkins explains that there were "wooden structures that were built in 1947 when the soldiers returned from the war and wanted to be engineers." These buildings housed a variety of things: graduate student offices, drafting courses and the Breese Terrace Cafeteria. The cafeteria was in operation before the original Union South was built and had what Myers says was an "assembly line style, automated cafeteria with machines flipping hamburgers and food coming out of the wall onto your tray." Unfortunately, the building burned down, and the first Union South was built in 1971.

Other academic buildings have changed drastically as well. Tompkins says that when he first came, "Engineering Hall was only the two E's with nothing in the middle, and kids would sit out in the grass and throw Frisbees around." The Mechanical Engineering building was also very different, with the middle section only one story high and "an empty space where there was a volleyball court," Tompkins says. The renovation of the Mechanical Engineering building came in 2005, and Uicker says, "It's a beautiful building now, but where did the blackboards go?" Myers chimes in, "Yeah. Bring those back."

The physical structures of the college have changed drastically over time. Uicker jokes, "There even used to be parking lots where actual people and students could park."



On Department Changes...

Over the years, there have also been many changes within the departments of the College of Engineering. New departments have been formed. Both industrial engineering and nuclear engineering grew out of the mechanical engineering department in the sixties. Tompkins himself was one of the three founders of the biomedical engineering department in 1999. "It was very much, to me, like starting a little company," he says. Their first class of graduates in 2001 had only 11 students, and this year they will have 65.

There also used to be a department called general engineering, housed in the temporary army buildings. "It taught the service courses in drafting and technical writing for all other majors; it didn't have a major of its own," Uicker explains. He was chair of the department when it dispersed its courses into the different, more appropriate departments, and he says that he was "the first chair in the college to request that their department be abolished."

Bottom Left - Courtesy of Phil Biebl: Engineering computer labs in their prime

Middle Right -Courtesy of Phil Biebl: Drawing of an engineering building in its early stages

Far Right- Courtesy of Willis J. Tompkins: LINC-8 (Laboratory INstrument Computer) in 1974 used for Biomedical Engineering Research

On Changes in People...

Over the years, the people of the College of Engineering have also been slowly transitioning. When Myer first came to UW-Madison, he had "one woman in a class about every five years." Tompkins says that "while the first female faculty in the college was Lois Greenfield, the first female engineering faculty didn't come until the 1990s, and her name was Denise Denton." Now, Corradini states, "We have multiple chairs of departments who are women." All of them agree on one thing: it's a good change. "The presence of more women has been wonderful. If you're trying to solve problems, the best thing you can do is have people who look at issues in different ways," Robinson says.

However, there's still a ways to go. "15 percent? That's still not many. 50 percent is a cultural change; we're not even at the reaching that stage yet," Corradini says. Tompkins envisions "the future with the college having statistics at minimum equal to the amount of racial diversity of Wisconsin and the male to female ratio at 1:1." WE

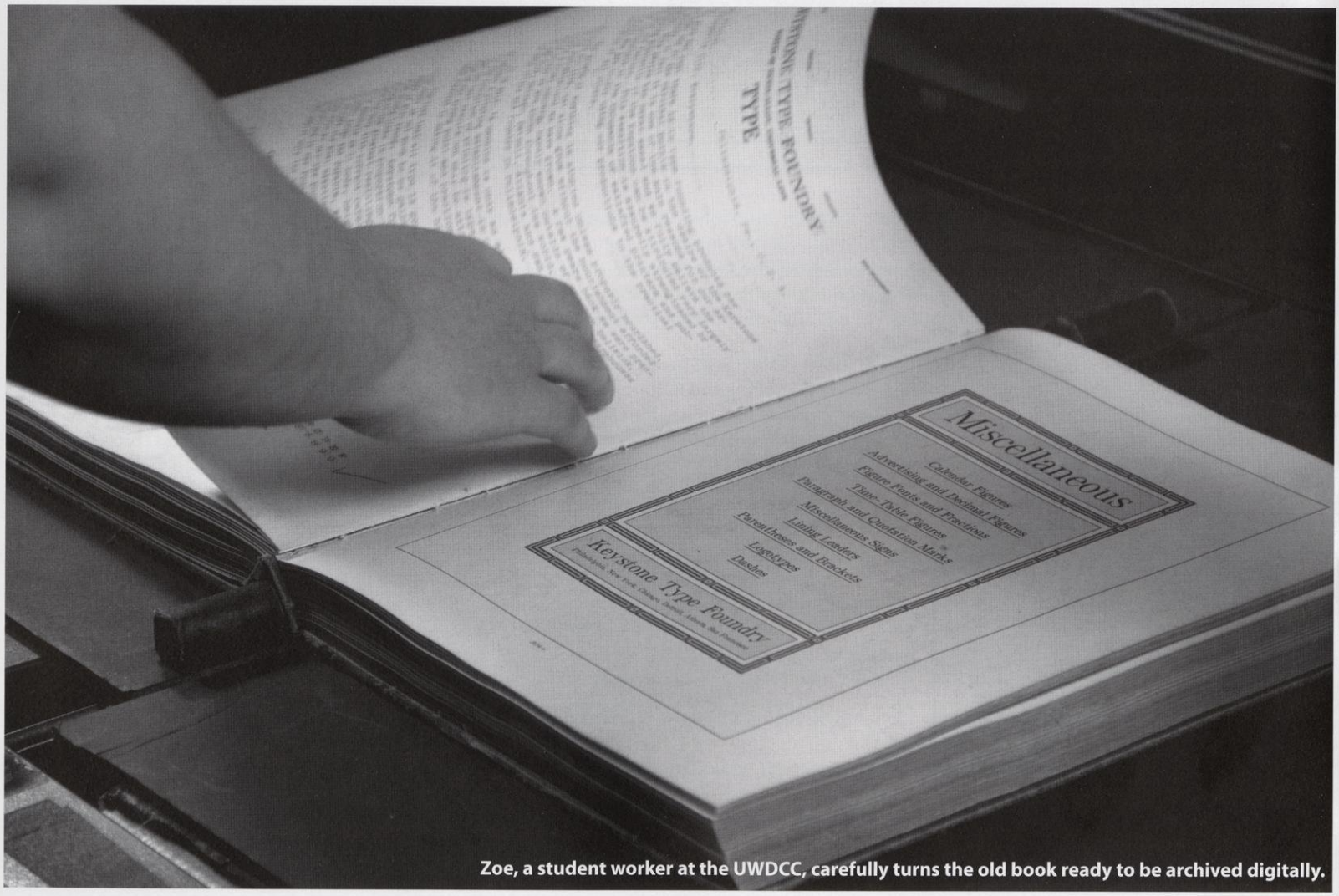
A Peek Into the Past

The University of Wisconsin Digital Collections Center provides teachers, students, and citizens of Wisconsin with a rare look into the past and present history of the state.

Often heralded as one of the top colleges in the U.S., UW-Madison has enough majors, student organizations and athletic events to keep any student busy, both inside and outside of the classroom. The hectic nature of being a student at UW-Madison is something that current and former students can appreciate. Although the rigors of college life have remained unchanged, UW-Madison certainly has not. From extensive renovations to completely new construction, the UW-Madison campus has evolved substantially over the course of its existence. So if you have ever been wondering what it was like to attend UW-Madison 50 years ago, look no further than the University of Wisconsin Digital Collections Center (UWDCC).

With a wide range of resources across numerous media platforms, the UWDCC offers a peek into what life was like at UW-Madison and around Wisconsin years ago. Books, maps, posters, audio recordings and videos are just some of the many materials freely available to the public. These materials are primarily gathered from the UW-Madison library collections, academic departments on campus, faculty teaching collections, images from research trips, campus museums, cultural institutions and UW System libraries.

Founded in 2000, the UWDCC has worked collaboratively with UW-System faculty, staff and librarians to create and provide access to digital resources that support the teaching and research needs of the UW community, uniquely document the university and state of Wisconsin, and provide access to rare or fragile items of broad research value. Melissa McLimans, a digital services librarian at the UWDCC, describes the importance of serving all citizens of Wisconsin, saying, "We firmly believe in the Wisconsin Idea,



Zoe, a student worker at the UWDCC, carefully turns the old book ready to be archived digitally.

which states that 'the boundaries of the University are the boundaries of the state,' but we get to take that a step further and make the resources available globally." While scanning hundreds of books and digitizing an even greater number of images required an extensive amount of time and money, the mission of providing access to comprehensive digital resources is deeply important to the UW System.

Today the UWDCC continues to build upon the ideas and goals which led to its establishment 14 years ago. New resources are constantly being added to the collections in order to document new developments and add to existing collections. A regular production schedule ensures that hundreds of images, audio files and dozens of books and maps are added to the collections on the first Tuesday of every month.

The regular expansion of the collections is and will continue to be especially beneficial to faculty, staff and students operating within the UW System. The future goal of adding digital content to the library catalog will allow students to search for UWDCC images, books and other resources alongside traditional library catalog materials. The UWDCC also plans on making digital materials easier to use in the classrooms as well as in research in order to meet the needs of faculty that require digital resources.

In addition to improving access to the collections, the UWDCC also partners with citizens across the state to create new content. "We work with faculty, librarians, students and community members to develop new projects as well; working with people to determine what will make a compelling and realizable digital project is a core function of the UWDCC," McLimans says.

"We firmly believe in the Wisconsin Idea, which states 'the boundaries of the University are the boundaries of the state,' but we get to take that a step further and make the resources available globally."

This continued community outreach is also present through the UWDCC Facebook and Twitter accounts. Social media has been an excellent way for the UWDCC to post materials from the collections in some non-traditional spaces that researchers and patrons visit. This fun and informal interaction with users over the past six years has brought the UWDCC increased recognition around campus, along with greater excitement surrounding the collections.

McLimans goes on to describe the positive dialogue created through social media by saying, "Because our work is online, we do not have the same sort of opportunity to talk with people at the reference desk, but through social media, we get to hear people's reactions to our materials." She continues, "More and more people are asking us reference questions on Twitter and Facebook."

As the UWDCC continues to seek out new ways to interact with and better serve UW System faculty, staff and students, as well as citizens of the state and scholars in general, there is little doubt about whether the UWDCC will proceed to be a tremendous source of information regarding the UW System and the state of Wisconsin. By providing students with a glimpse of the long and detailed history of UW-Madison, the UWDCC finally might be able to answer the question of what it was like to attend UW-Madison 50 years ago. WE

Written by: Matthew Latuszek
Photography by: Parwat Regmi

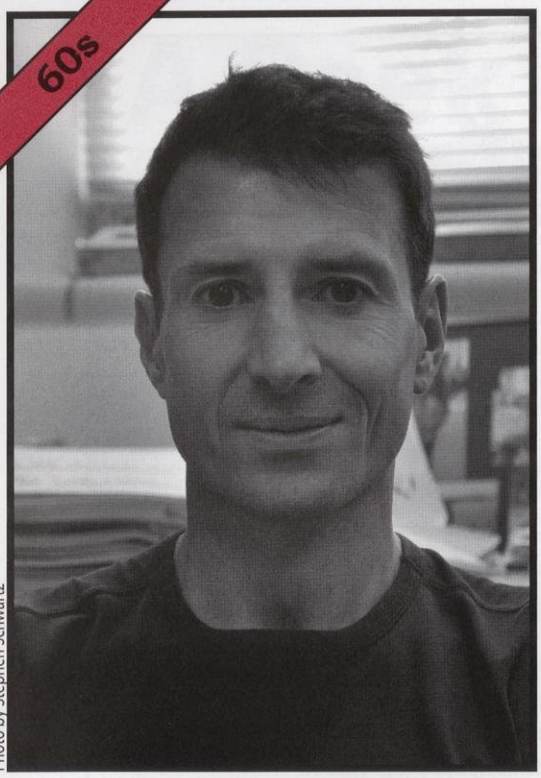


Photo by Stephen Schwartz

PROFESSOR PROFILE
THOMAS BRUNOLD

By Stephen Schwartz

"In all honesty, it's just fundamental research to understand bonding properties and the key steps in this reaction cycle." –Professor Brunold

As a beloved chemistry professor, caring father and inspirational athlete, Dr. Thomas Brunold embodies the very essence of what it means to be a part of the UW-Madison faculty. Since beginning here in 1999, Dr. Brunold has graced this campus with his enthusiasm for teaching, renowned interest in students' success and impregnable curiosity for discovery. His research—revolving around the fundamental understanding of molecular bonding using a combined approach of experimental spectroscopy and computational validation—has led to many influential publications and distinguished awards. Few freshmen realize how lucky they are, as they absent-mindedly sign up for their required general chemistry class, to begin their college careers with such a talented and remarkable individual as Brunold, and it is these students that, according to him, make his job so enjoyable.

Whether it's teaching introductory level courses or advanced inorganic chemistry, Brunold says his favorite part is "definitely the interaction with students," especially, he says, the "success stories." These include, for instance, particular cases in which students come in apathetic about chemistry, but after taking his class, realize it isn't so bad and actually develop a newfound appreciation for the subject. Other examples include those who initially struggle with the material, but after coming to office hours and developing a strategy, they eventually achieve success. It's reasons like these that keep Brunold eager to teach and is part of why he always garners such positive feedback from his students.

Growing up in the capital of Switzerland, Brunold attended the University of Bern as an undergraduate student. During his stay here, he remained extremely physically active and developed a great interest in kayaking. Brunold, however, was more than just the average student athlete; he worked tremendously hard and eventually made it to the international level, competing in the 1992 Summer Olympic Games for slalom kayaking in Barcelona. "It's amazing, it's like two weeks of total paradise," says Brunold, reminiscing on his unique experience. After the games, Brunold dove immediately back into his studies and completed his coursework for his Bachelor's degree a year later. He never took extended periods of time off from school which he admits was intense and demanding at times, but he enjoyed the challenge.

Brunold went on to receive his Ph.D in chemistry, also from the University of Bern, and opted to stay in academia rather than enter industry. He was offered a post-doctoral position at Stanford University which is what first drew him to the United States. After a few years there, Brunold finally came to UW-Madison where he has happily resided ever since.

Despite the change of scenery, Brunold never lost touch with his athletic background. Motivated by the threat of getting out of shape, he took up swimming and biking as a pastime and eventually learned about the local Ironman triathlon that takes place annually here in Madison. A 2.4 mile swim and 112 mile bike ride is capped off by a marathon run in this extremely physically demanding race. Thomas began participating in 2003, and won his age group's division for the first time in 2005. Since then, he has competed in the Ironman in Wisconsin every year, and has even raced at the World Championship in Hawaii. Although he has yet to win in Hawaii, Brunold is confident that he will have a shot the next time he makes the trip.

With all the time he spends teaching, training and competing, it's hard to imagine that Professor Brunold can still dedicate significant time to conducting quality research, but somehow he finds a way to fit it all in. Early in his career, he became interested in laser materials and started investigating their electronic properties in certain environments. Many of these properties stemmed from the presence of an active transition metal ion in the material. Using the same concepts as before, he began studying more biologically relevant molecules, such as enzymes, during his post-doctoral stay at Stanford. Enzymes, while extremely complex and composed of thousands of atoms, still only have a single metal atom, and it is here at the active site where the action occurs.

"We have many techniques that allow us to selectively probe the active site," says Brunold, and these are used in conjunction with each other to develop reliable data on the electronic properties for the molecule under investigation. In turn, this data is used to understand the particulars of the bonding involved in the reaction. For example, the Brunold Research Group can look at a specific bond and determine if and where it forms, and what exactly is happening during the whole process.

However, there is more at work here than simple spectroscopy techniques; there are numerous factors that must be taken into account to ensure accurate and useable data. For example, Brunold's research group must find some way to trap the enzyme in question in an inactive state so that they can collect the data in the first place. Referencing an enzyme that catalyzes a reaction with O2, Brunold explains, "we need to play little tricks, instead of using oxygen we can use nitrogen oxide," a similar molecule that can bind but prevents the reaction from proceeding.

The Brunold Research Group publicizes a large Yin and Yang symbol on their website, which Brunold explains, stands for the interconnected nature between spectroscopy and computation. He says that the two go hand-in-hand. If the computer can reproduce their measurements, then their data is meaningful and accurate. This idea of using both approaches to study bonding is a central element of Brunold's research philosophy.

While in the long term it is possible that Brunold's research can lead to the synthesis of a new drug, he admits that "in all honesty, it's just fundamental research to understand bonding properties and the key steps in this reaction cycle." All of this information gathered can provide useful insight and be applied to a number of different situations. There is significant interest in the field for just fundamental understanding, and it is groups like Brunold's team that are actively seeking these answers. In the meantime, professor Brunold will continue to inspire his students with his charismatic enthusiasm, push them with his high yet attainable standards, and shock them with his unyielding ability to rock shorts to lecture even in the dead of a Wisconsin winter. WE

Climate Combat through Climate Quest

by Nathan Friar

Global warming is a term that can instill both apprehension and helplessness in the minds of those who are aware of it. The evidence is clear, and the data supports what most experts agree on; the earth is getting warmer. With this conclusion comes a flurry of dire predictions: among them droughts, crop failures, rising sea levels and more intense storms. With all of these damaging and violent effects, it can be easy to be overwhelmed by the negativity of the situation. A UW-Madison campaign titled Climate Quest is looking to turn away from this pessimism and instead develop ideas that could have a positive impact climate change mitigation.

Led by the UW-Madison Office of Sustainability in partnership with the Global Health Institute, Nelson Institute for Environmental Studies, Sustain Dane, and Wisconsin Energy Institute, Climate Quest is a recently founded competition with a mission to bring together teams of intuitive and determined individuals that have "practical, high-impact solutions to mitigate or adapt to climate change," says their website. Coming from very local roots, Climate Quest began with the ideas of ten senior UW-Madison faculty members. These distinguished campus personnel met for about six months to discuss how they could potentially tap the ideas of the campus and the community. They found their answer in Climate Quest.

Starting on April 4th, multiple teams of faculty members, non-profit members, prominent community members and students were invited to submit an initial idea. Darin Harris, a team leader for Climate Quest, describes that preliminary idea a "seed." These ideas could be anywhere from a product, a set of policies, to social innovations – basically anything to reduce carbon or adapt to climate change. "We then give you the tools, skills and resources necessary to grow the idea into something bigger that can carry a lot of significance," says Harris. When considering the fact that the entire globe shares the same atmosphere, these ideas could be implemented in a wide scope of locations. Whether that means locally here in Madison, somewhere else in Wisconsin, or across the globe, the scope of Climate Quest will be whatever the teams make it to be.

Once the initial idea was submitted, each of the twenty teams participated in a solutions workshop held in early June. There the groups were advised on how to move forward with their ideas by a design consultant expert who works with Fortune 100 companies. The fact that Climate Quest brought in someone of this caliber highlights its commitment to helping the competitors succeed. "Although it is a competition, we do help you get started," says Harris. This early professional development opportunity was laying a foundation for groups to build upon until late August, where they presented their more developed ideas to a selection board. This board, made up of individuals in various disciplines with an interest in the subject, decided which teams deserved the opportunity to further develop their idea. The teams selected then received a budget to turn their carefully molded ideas into a full blown proposal, which will be presented this December. At this time, one to three winning groups will be awarded significant grants in order to fully implement their ground breaking solution.

Photo by Matt Henricks

The Wisconsin Energy Institute is a partner of Climate Quest. Pictured here, their world-class building helps researches advance technology in clean energy.

> *"Rather than spending all of our time saying 'Oh no, it's finally upon us' we can say here are some things that are going to have a big impact on climate change."*
>
> *-Darin Harris, Climate Quest Team Leader*

In order to stand out amongst the crowd, Climate Quest is striving to differentiate itself from the concept of a typical climate change think tank, says Harris. "I wouldn't call us a think tank, because we're not focused on research. We're looking on taking this already great existing knowledge on climate change and make it practical and have high impact. That's Climate Quest in a nutshell." With this research already brought to the table by the diverse individuals who make up the teams, Climate Quest is putting itself in a position to make substantial positive impacts.

While the remaining teams are now deep into the development of their final climate change solutions, it's still possible for those who would like to get involved to do so. Harris encourages students and other members to come and see what's happening with Climate Quest. "See what's happening, and get inspired. See how you can apply this to your study and to your work life, so when the next round of Climate Quest rolls around, you'll have some really cool ideas."

Although he can't yet divulge any specifics about the ideas submitted to Climate Quest, Harris is very optimistic. "We were hoping that we would get ideas that span across the disciplines, and we've gotten exactly that. For instance engineering and the arts, or finance and engineering. So we're very happy to see that." This variety will be a key factor in developing unique, game changing ideas. The diversity also embodies the future of Climate Quest. With so many great ideas already, Harris and the other members of Climate Quest are looking towards the future. "We are hoping Climate Quest will be an ongoing program. Climate change is not going away, so we hoping to improve and continue to deal with this down the road." Clearly, this local initiative is thinking big, which will be beneficial when tackling a problem as large as global warming. Keep an eye out on this intense competition, because Climate Quest just might help shape our planet's future. WE

80s

Seeking Sigma: The Scoop on Engineering Greek Life at UW-Madison

by Rick Zuern

UW-Madison students discuss the advantages of going Greek, and what starting a new Greek chapter on campus is like.

Langdon Street isn't the only place on campus to find Greek letters. Greek life at UW-Madison has continued to be a core part of the undergraduate experience for many students, both in and out of the College of Engineering. Social and professional societies are dotted all over campus in a variety of disciplines, and engineering is no exception. Many College of Engineering students find immense benefit in joining an engineering-focused fraternity or sorority. The magazine spoke with Arthur Piatt, President of Triangle Fraternity, and Bat-Zion Hose, Regent of the co-ed Theta Tau Fraternity, to further illuminate the undergraduate experience of being involved with an engineering fraternity at UW-Madison.

"There's a benefit in holding one another to a certain standard – socially, academically and professionally," Piatt says. Triangle's stated goal is to "develop balanced men in engineering, architecture and science by providing an environment which fosters personal growth and professional success." Members will often work together on academic pursuits, fraternity gatherings and charity events. In Theta Tau, Hose notes that membership in a fraternity also shows a marked increase in undergraduate retention in engineering programs. "A lot of us have classes together, we'll help each other with projects and have study nights that everyone can come to," Hose says.

Long-standing fraternities like Triangle and Theta Tau will often have a large network of alumni and professional contacts accessible to their members. Theta Tau will often host "Spaghetti and a Guest" events, Hose says, where members can invite faculty members or employers from past internships to come and speak about engineering in the workplace and how to plan for continued success. Fraternity connections can even directly influence career paths. "From a professional development standpoint, pure networking is a huge part of what Triangle has offered me," Piatt says. Piatt is currently employed at a company where he works alongside two Triangle alumni from UW-Madison. For these reasons, members of Triangle and Theta Tau have legacies that remain on campus well beyond graduation day.

"There's benefit in holding one another to a certain standard – socially, academically and professionally"

– Triangle President Arthur Piatt

Despite the powerful history of tradition and service in these fraternities, some students seek to develop their own means of association during their time in the College of Engineering. Mitch Stamp joined sophomore Michael McGovern as part of a team of about 20 engineering undergraduates that sought to colonize a new fraternity chapter here at UW-Madison.

McGovern, Stamp and their new fraternity brothers came together last spring with the goal of establishing a chapter of the national Sigma Phi Delta fraternity on campus. "We really wanted to be able to make the fraternity our own," Stamp says. "Being able to work with such like-minded people and to forge strong bonds between the founding members is a great motivator."

Starting a fraternity involved weekly meetings for McGovern and his team, in addition to the monumental amount of paperwork that needed to be filled out. "You need to tell the national chapter that you're looking to colonize," McGovern says. McGovern and his colleagues were initiated into the freshly formed local colony as pledges last spring, which they remain for a semester until they can formally begin recruitment in Spring 2015 as full members. From there, the fraternity will begin to fully develop into the body that McGovern and Stamp are hoping for.

"We're looking to be a social and a professional fraternity," McGovern says. One thing that both McGovern and Stamp are looking forward to is developing community service projects with their new fraternity, especially those with a focus in engineering. "We want to be able to forge new traditions, establish new connections with people and ultimately to establish lifelong brotherhood," Stamp says.

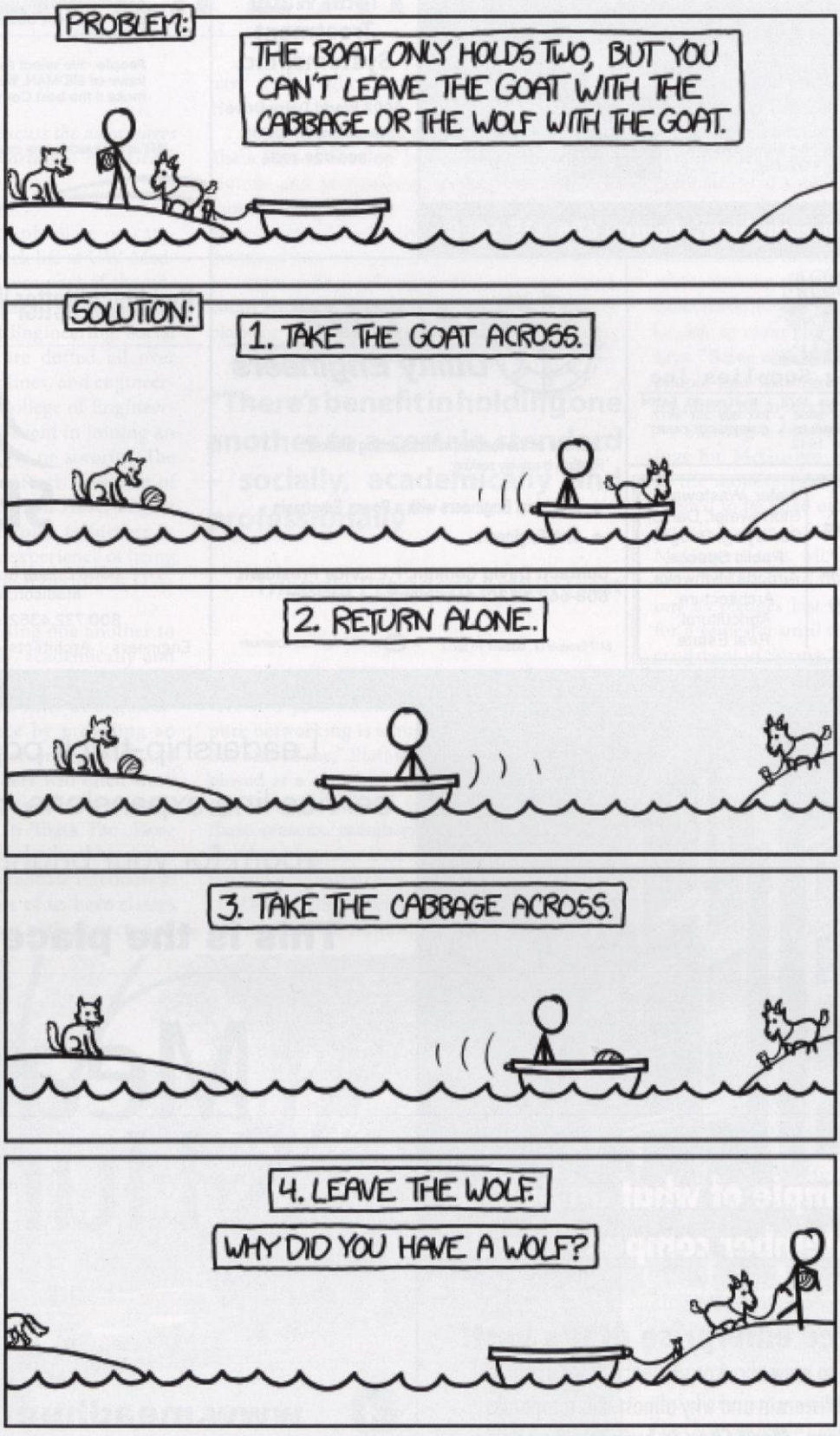
The founders of the new Sigma Phi Delta chapter have lofty plans for the future. "Sigma Phi Delta encourages their chapters to develop their own bylaws and rules so that all of the chapters around the country are unique. We plan to charter by spring semester of this year and get a house within the next four years," McGovern says.

Greek life at UW-Madison is a core component of the personal, academic and professional development of many engineering undergraduates. Membership in an engineering fraternity or sorority enriches the college experience for an individual student by providing easy access to like-minded peers to share thoughts on course material, social events and career goals. Although fraternities like Triangle and Theta Tau are here to stay at UW-Madison, the ranks of Greek societies on campus will undoubtedly only continue to grow with new additions as students begin to find their way into the future. We

Photo by Mitch Stamp

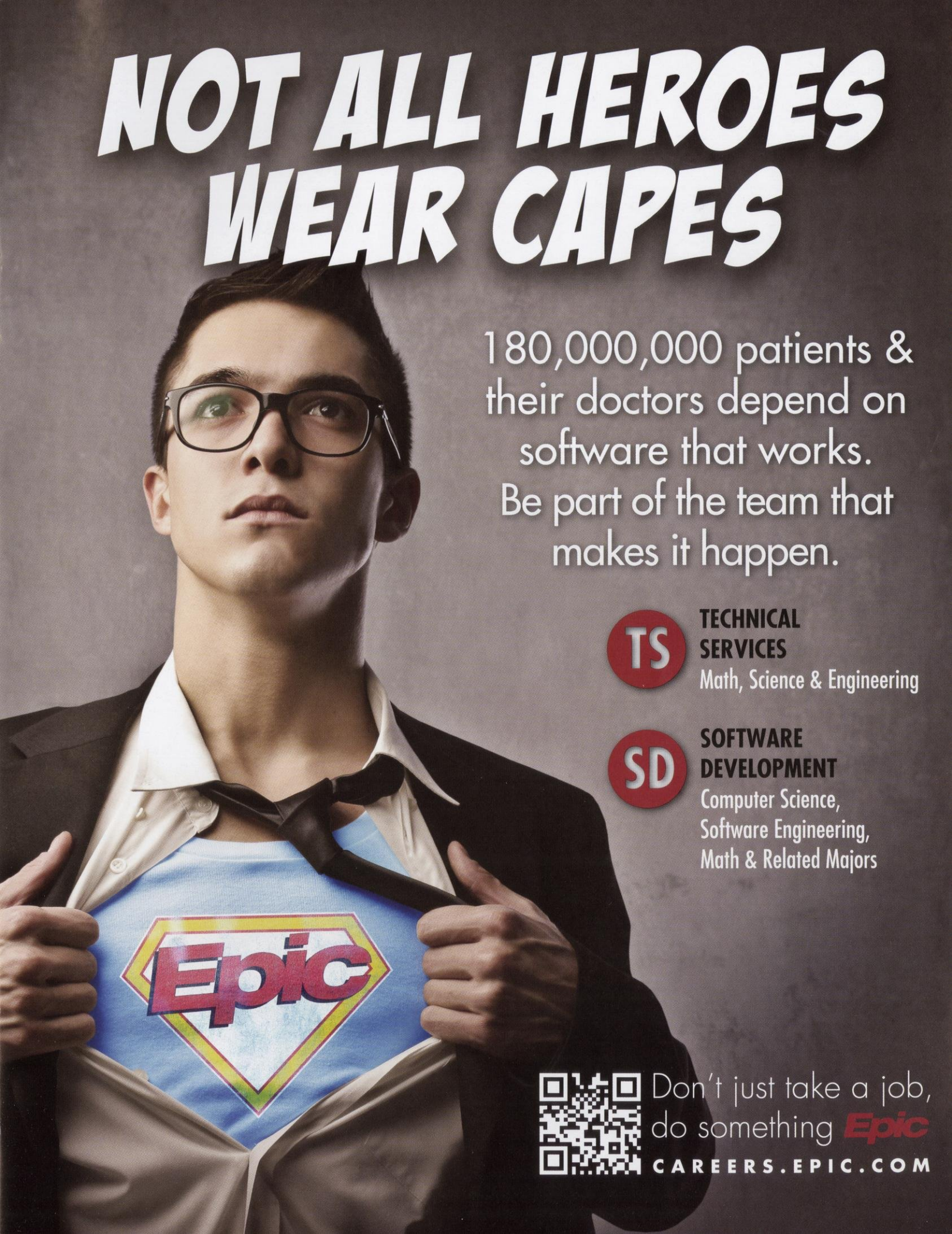
Historic Langdon Street is home to many of UW-Madison's Fraternity and Sorority houses.

Just One More...



Or a cabbage, for that matter? The goat makes sense. Goats are fine. Image used under Creative Commons Attribution-NonCommercial 2.5 License

Comic provided by xkcd - check out xckd.com for more!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