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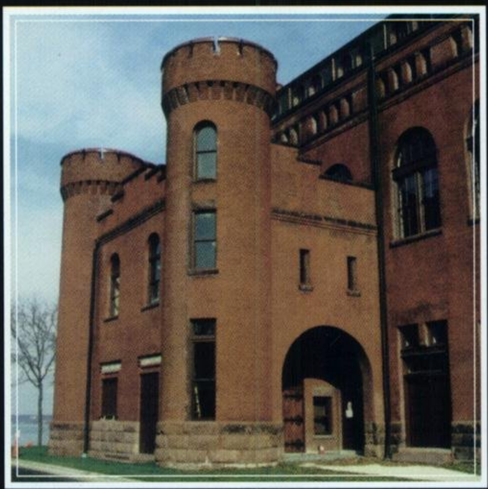
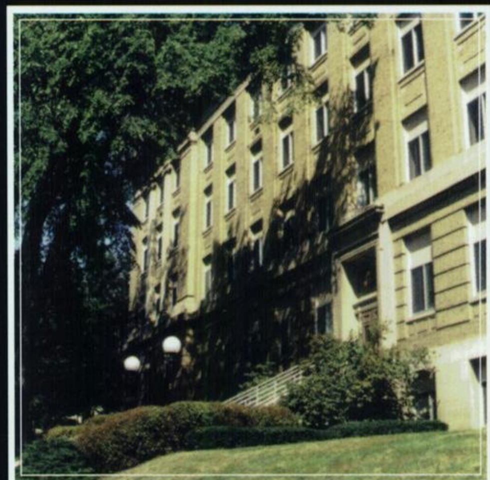
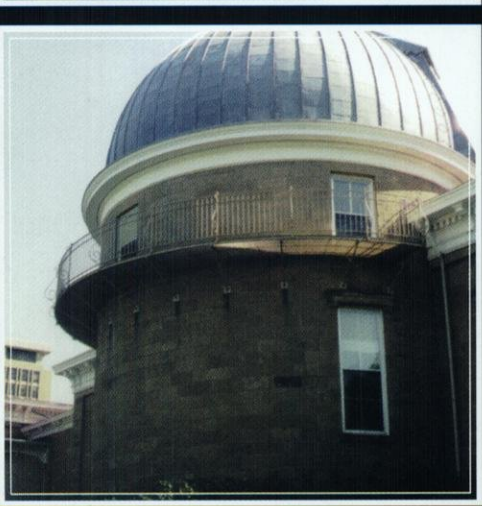
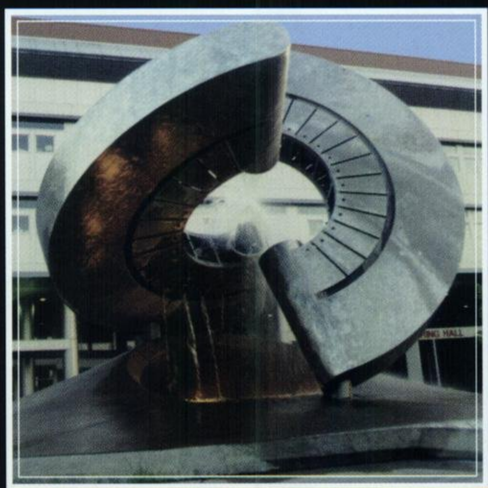
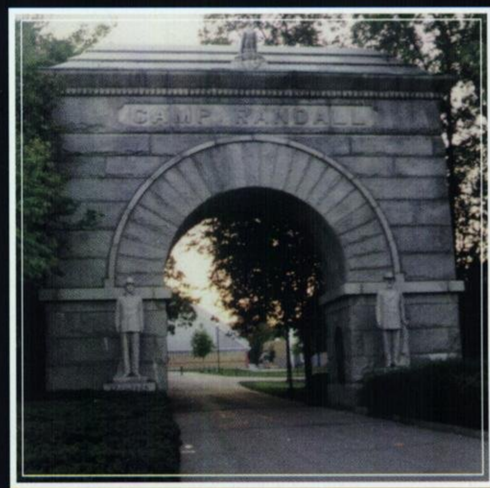
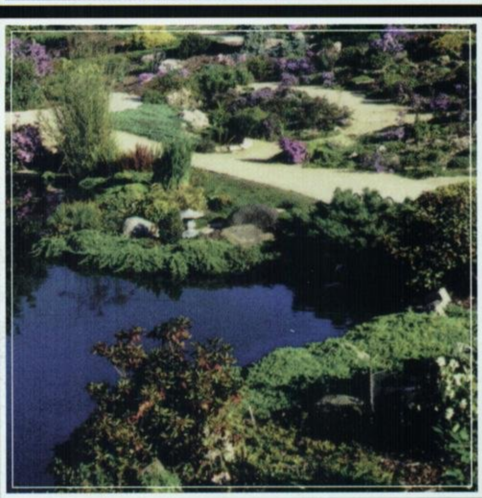
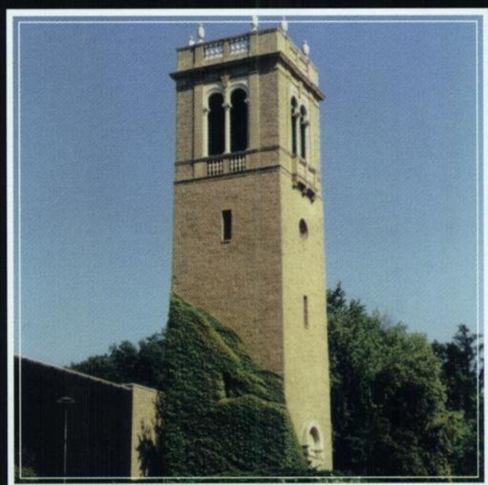
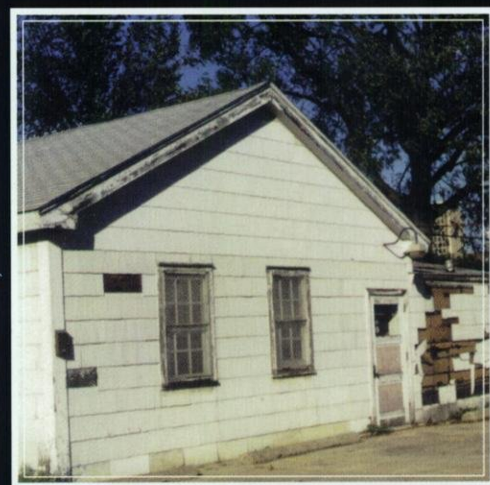
NOVEMBER 1998
VOLUME 103, NUMBER 1

WISCONSIN ENGINEER

Discover Wisconsin's campus history in these pictures

Sesquicentennial photo essay inside

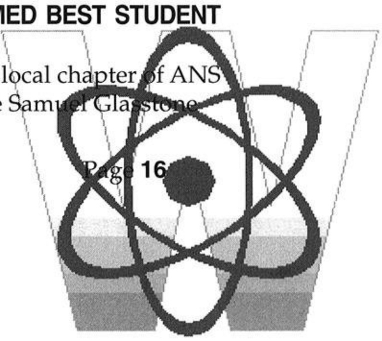
WISCONSIN ENGINEER

Published by the Students of the University of Wisconsin-Madison

TABLE OF CONTENTS

VOLUME 103, NUMBER 1 NOVEMBER 1998

FEATURES



DEPARTMENTS

TO CONTACT THE *WISCONSIN ENGINEER*: LETTERS 1513 University Avenue Madison, WI 53706 EMAIL • WEB wiscengr@cae.wisc.edu http://www.cae.wisc.edu/~wiscengr PHONE 608-262-3494

$25 Million . . .Can you afford to have a University building named after you?

How do you get a University of Wisconsin-Madison building named after you? Making a scientific breakthrough or having a positive impact on the University doesn't seem to be enough anymore. So, what does it take?

$M-O-N-E-Y!

Money makes the world go round, right? The assistant vice chancellor for facilities planning and management, Bruce Braun, said, "The naming of buildings for wealthy donors is a sign that campus leaders are looking for solutions to space requirements in a time when the amount of state support for higher education is declining." Braun feels it is a recognition of reality and states, "The fact is we won't have the facilities if we don't go out and raise the money for it."

Of course, rules exist to the UW-Madison "name game." In the UW-system, the Board of Regents has the final say. Before building name approval, the Board of Regents privately discusses the approval of naming a building. In the past, they have typically favored names of employees who have died or left university employment. However, in recent years it seems that the only names going on buildings are wealthy benefactors.

An article written by John Welsh in the Wisconsin State Journal, "What's in a name? History," discusses the history behind naming several UW-Madison buildings. For example, Babcock Hall (1948) was named after Stephen Babcock, one of the University's top scientists who revolutionized the dairy industry by perfecting the way to test milk for butterfat content, and Helen C. White Hall (1969) was named after an adored and well-respected English professor, Helen C. White. Also, John Bascom, the University's sixth president and a key leader in its development, received the honor of having Bascom Hall (1857) named after him. Other examples include John Sterling (who taught the first University class), Harry Steenbock (who made several landmark discoveries involving Vitamin D) and Harry Waisman (who did pioneering research in the causes of developmental disabilities).

Two recently erected buildings, Grainger Hall of Business Administration (1993) and the Kohl Center (1998), have a different history behind how they received their names. David Grainger is a 1950 UW-Madison graduate and is the chairman of W.W. Grainger, a company in Skokie, IL, that sells industrial products. Herb Kohl is a U.S. Senator. What do Grainger and Kohl have in common? They both got a UW-Madison building named after them because they donated a large sum of money. In fact, Herb Kohl broke the record by donating $25 million, the largest sum in University history.

In about two years, at the southeast corner of Breese Terrace and University Avenue, construction will begin on the new engineering facility, Engineering Centers Building. Will the University choose the new building's name based on merit or money? Before the University makes a final building name decision, I hope the words of Arthur Hove, a campus historian, ring loud and clear:

" . . . knowing the names of buildings and the people behind them is key to knowing why UW-Madison is special. If you start looking at these people, they personify what this institution is all about."

Shana Gadlin

University of Wisconsin Madison

The College of Engineering University of Wisconsin-Madison

The *Wisconsin Engineer* magazine, a charter member of the Engineering College Magazines Associated, is published by and for engineering students at UW-Madison. Philosophies and opinions expressed in this magazine do not necessarily reflect those of the College of Engineering and its management. All interested students have an equal opportunity to contribute to this publication.
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News from COE Organizations

Pi Tau Sigma

With the twentieth century came the realization that honor societies made a definite contribution to the department and that membership required active participation. Pi Tau Sigma came into being on March 16,1915, at the University of Illinois. A similar organization embarked November 15,1915, at Wisconsin, and other local organizations were soon to become active.

This tradition has continued here at UW- Madison. Pi Tau currently has about 75 active members who are involved in a variety of ways. One of Pi Tau's biggest contributions to the engineering campus is its tutoring service. Tutoring is offered Sunday throughThursday evenings at Wendt library. Members volunteer to tutor first and second year ME students in their math, science and engineering classes.

Pi Tau also holds general meetings twice a month, featuring a variety of speakers. This semester, meetings have focused on helping members prepare for life after they complete their undergraduate degree. Topics this semester include the benefits of graduate school, research opportunities on campus and financial planning. Pi Tau offers a great outlet for students in mechanical engineering to meet other students, as well as faculty and get involved on campus.

Institute of Electrical and Electronics Engineers (IEEE)

What is IEEE at the University of Wisconsin-Madison?

The Institute of Electrical and Electronics Engineers (IEEE) is a group of more than 300,000 professionals and students from more than 150 countries. IEEE was founded in 1884 and is the largest professional association in the world. It is the best source of electrotechnology publications in the world and accounts for more than 30 percent of the total publications. At the local level, we are an organization of about 220 members. We have at least one plant tour a semester and plan regular meetings once a month. During the meetings, we have companies or distinguished speakers do presentations for our group. We also have social activities, such as a barbecue, bowling and volleyball.

What are benefits of joining IEEE?

All IEEE members receive a personal subscription to the IEEE Spectrum magazine. With this, IEEE members gain an edge by using the best technical information on electrical and computer engineering in the world. Also, UW-Madison professors have written for IEEE Spectrum. IEEE is a great opportunity to network with other students and industry. It is time to get involved, so pick up an pplication! They are available from the IEEE bulletin board, located next to the ECE professor mailboxes in Engineering Hall on the first floor. Just complete the application and place it in the IEEE mailbox next to the bulletin board and you will be a member too!

If you have any more questions or comments, please email ieee@cae.wisc.edu and we will address them.

American Society of Mechanical Engineers (ASME)

The UW-Madison chapter of The American Society of Mechanical Engineers is one of the most active chapters in the nation. The fact that we have won the Allied Signal award three out of the last four years represents our remarkable accomplishments. Winning the Allied Signal award entails the avid participation in contests, fundraising, conferences, meetings, social events and professional development that our chapter displays. Our "work hard, play hard" motto makes us both a fun and distinguished organization.

First, ASME offers great academic support for its members. ASME provides extraordinary ways to get to know your professors better. This is achieved through Pizza with Professors and by having professors come as speakers at our biweekly meetings. Schedule advising sessions are held before registration to help students choose their classes wisely. We also have an extensive exam file that can be used to prepare for upcoming tests. Secondly, a major objective of ASME is professional development. ASME has members of industry speak at our general meetings. ASME holds resume workshops and releases a resume book to companies at career connections. The industrial relations committee plans plant tours at least once a month so members can get a feel for what an engineer actually does outside of college. As well as individual development, we also enjoy improving the community around us. We participate in blood drives, Habitat Through Humanity and Christmas 4 Kids just to name a few. Our outreach committee also organizes such programs as High School Day on Campus to inform high school students about the field of mechanical engineering.

On the lighter side, ASME holds various social events and provides a fantastic way to meet new people in the College of Engineering. This all starts with our general meetings where free pizza and soda are always served. The beginning and end of every year is marked by a cookout, and socials at local bars are held throughout the year. During the football season our tailgates are unbeatable! Highlights of our tailgates include hot tubs, pig roasts and WMAD 92.1FM broadcasting live. Finally, there are the conferences that we attend in the spring and fall. These conferences are not only a great way to learn more about ASME or engineering in general, but are also a fun way to interact with fellow members throughout the nation. Our impeccable reputation can only be accomplished through the hard work and dedication of not only our officers, but also our members at large. ASME is a wonderful way to get involved, meet new people, develop leadership skills and have a lot of fun.

American Institute of Aeronautics and Astronautics (AIAA)

The University of Wisconsin-Madison chapter of the American Institute of Aeronautics and Astronautics provides activities and discussions for students interested in aerospace and related disciplines. Recently, our chapter has been involved in activities ranging from hosting a model rocket competition to touring Kennedy Space Center.

Our second annual Model Rocket Competition for middle school students was held May 1, 1998. The competing students worked in teams to design and construct a model rocket which they launched from the UW campus. They were judged on the appearance, flight and altitude of their rockets, along with their written and oral presentations. The competition was once again a great success and will be continued next spring.

In addition to our on-campus events, AIAA has sent its members across the country. Last January, seven members of our chapter visited Kennedy Space Center in Florida. While we were there, we toured the US Astronauts Hall of Fame and the Kennedy Space Center Visitor Complex. Then, last April, four chapter members participated in the NASA Reduced Gravity Student Flight Opportunities program in Houston, Texas. This program gives students the chance to construct and perform an experiment in microgravity on Johnson Space Center's flying reduced-gravity laboratory, commonly known as the "Vomit Comet." Our UW-Madison team studied the effects of gravity on a polymer formation reaction. AIAA plans to send at least one team to Houston this year.

Engineering Expo

Engineering Expo is a biennial, student-organized technology exhibition. Its purpose is to acquaint the public with recent technological advances developed by the college of engineering and industry. Expo '97 featured more then 90 industrial and student-organized exhibits and was attended by more than 16,000 students, faculty and guests. The Robot Trialatholon Competition showcased the creativity and teamwork of engineering students.

The goals of Engineering Expo are:

1. To demonstrate the advance of technology through student and industrial exhibits.
2. To provide engineering students with practical design experience, emphasizing integration of engineering disciplines, creativity, innovation, research, and teamwork.
3. To educate K-12 students, post-secondary students and the general public about engineering, its applications, and important roles in everyday life.

For Engineering Expo '99, we are expecting over 100 industrial and student exhibits. Expo is comprised of engineers of all disciplines, and grade levels. Expo will be seeking volunteers in the spring of 1999 to aid with the event, in areas such as setup, logistics, sales, and guest liasions. Expo has many opportunities for students to make important network connections in industry. Exhibitors develop skills and gain recognition. Take a look around you. You're surrounded by cutting edge technology. Become a part of Expo '99 and you'll become a part of a 59 year legacy. If you're interested, please email **expo@cae.wisc.edu** or visit our website at www.cae.wisc.edu/~expo.

Institute of Industrial Engineers (IIE)

The Institute of Industrial Engineers (IIE) has seen marked improvements over last year and continues to have fun, meet employers, learn about the profession and serve others. Recently, IIE traveled to the Milwaukee area to visit a GE Medical Systems manufacturing plant, spoke with recent IIE members and Industrial Engineering graduates, toured two manufacturing plants and grabbed some custard at Kopps in Brookfield on the way home. In October, IIE hosted the first ever intern/coop night where aver 60 students came to share their work experiences with each other. We also were helping Special Olympics with a bowling event that same weekend. Come join the fun!

Through innovation, improvement and devoted efforts, the chapter has quickly become one of the most active chapters in the nation. Now an annual ritual, visits to other IIE university chapters give a view of the profession at a national level and give new insight on the practice of Industrial Engineering. The chapter emphasizes personal, educational and occupational advising and exposure to its members through numerous plant trips, seminars, discussions and development activities. Also, IIE is involved in national IIE competitions, such as the Simulation Contest, Technical Paper Competition, Annual Scholarships and more. In the Spring of 2000, the UW-Madison IIE Chapter will host the IIE Regions 8 & 11 Conference. This conference will bring approximately 200 students, from schools such as Purdue, University of Illinois and Northwestern, to a networking, educational and invigorating weekend.

The Institute of Industrial Engineers has increased membership by 400% over the last 12 months. We have recently implemented a completely fresh and efficient organizational structure. This new structure emphasizes individual participation, facilitation of growth opportunities and national recognition. We are lead by our mission, which reads as follows: "To provide programs to facilitate industrial relationships, increase social interaction and enhance educational programs within the Industrial Engineering Department."

For more information, contact IIE at http://www.cae.wisc.edu/~iie or iie@cae.wisc.edu

American Society of Civil Engineers (ASCE)

UW-Madison's chapter of the American Society of Civil Engineers (ASCE) continues their dedication to give civil students opportunities to grow professionally, academically and socially. Starting this semester with over 110 members, ASCE has meetings every other week, committing themselves to community, outreach and industry-related activities. Our guest speakers have not only included leaders from construction and design firms, but also professionals to teach about finance, marketing and alternative ways to use our degree when we graduate. We have participated in professional conferences, Adopt-a-Highway clean-ups, academic advising, and look forward to Habitat-for-Humanity, Christmas for Kids and much more before the end of the semester. Our members also enjoy social activities such as football tailgates, sports teams and holiday parties.

One of the largest activities that ASCE members can participate in is the concrete canoe competition. This team dedicates the year to designing, constructing and racing a canoe made of concrete! Not only can members learn useful engineering principles by designing the hull of the canoe and formulating an original mix of extremely light-weight concrete, but they also get the opportunity to race the canoe against schools from all over the country. Over the past two years, the canoe team has won our regional competition and gone on to successfully compete at the national competition! The team is designing and testing concrete samples now; so, if you are interested, ASCE can make you a part of this exciting team.

Our Steel Bridge team also boasts an impressive regional win, advancing them to the national competition for the first time last year. Building on this accomplishment, this year, they will again design and build their own steel-member bridge. They are now in the design phase of construction and will soon begin the fabrication process. The team must construct this bridge to minimize the deflections when it is loaded with more than 1000 lbs. They also must practice to build the bridge on-site during the competition in the least amount of time. This is yet another way civil engineering students can have fun, learn and build their resume with team activities.

0The next months will be very exciting for ASCE as we prepare to host the regional ASCE convention in Madison this spring! This means our steel bridge and concrete canoe teams will compete at home against 18 other regional universities. On April 29-May 1, we will show what Wisconsin is made of! Until then, we will be planning to make this year's competition the best ever! ASCE offers many ways for all students to improve their education, have fun and get involved. Contact us at asce@cae.wisc.edu for more information to become a member of this quality team!

Badger Amateur Radio Society (BARS)

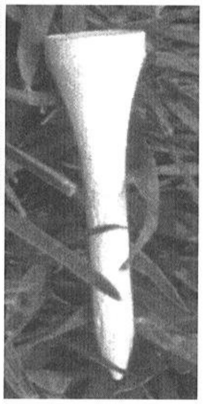
Amateur radio is a fun and diverse hobby. Anybody can be a "ham operator," no matter what their age or physical ability. Hams use two-way radios to communicate with one another on several modes which include Morse code, voice, digital and yes, even amateur TV. They get hooked on experimenting with different radio and antenna setups, building or modifying equipment and just simply getting on the air to chat. Amateur radio can provide hours of amusement and challenge toelectronics hobbyists. There are competitions too, often in the form of contests to see who can contact the most people over the widest area in the least amount of time. Many lasting friendships have been made over amateur radio. Ham radio isn't just one big money-and-time sink, either. Ham radio operators have proven themselves to be of vital importance when it comes to communications during natural disasters, when normal communications may be disrupted, or during police and search-and-rescue operations.

Badger Amateur Radio Society (BARS) is the UW radio club and was established in 1957 by the Electrical Engineering department at UW-Madison. "The Shack", or radio room, is currently located in room B265G of the Engineering Hall. A new facility within the future Engineering Centers building is being planned. Club members frequently engage in contests, field exercises, and "fox hunts." BARS also has a repeater on 146.685 MHz. BARS holds monthly meetings during which upcoming plans and budgets are discussed. Club members are free to use the equipment available in the shack. For hams on campus, it's a great opportunity to keep up with ham radio without having to transport the shack all the way from home. For people studying for their amateur license, it's a great way to familiarize oneself with the equipment and meet other hams, who can often offer helpful advice along the way. One does not need to be a ham to join BARS.

It's easier than one might think to get an amateur radio license. The FCC now offers a class of license called Technician No-Code, which has *no* Morse code requirement! Knowledge of Morse code, however, opens up more frequency privileges. To be granted a license, one must pass one or two multiple-choice tests, and, if desired, a Morse code test. The multiple-choice tests cover various topics including basic electronics theory, radio and antenna design, radio safety, and FCC rules and regulations. There are six classes of amateur radio licenses: Technician, Technician Plus, Novice, General, Advanced, and Extra Class. Each one offers more frequency privileges than the one before, and hams can upgrade their licenses by passing the test for the desired class.

Interested in joining BARS?
Please contact: Don Michalski, BARS secretary 263-4685, dem@sal.wisc.edu
Sign up using the BARS website on-line membership form!

To subscribe to the BARS e-mail list, send an e-mail to: majordomo@cs.wisc.edu with "subscribe bars" as in the text (no quotes).
BARS email is: w9yt@wpyt.engr.wisc.edu
BARS web site is: http://w9yt.engr.wisc.edu


Source: KPT Power Photos

Tee It High And Let It Fly

As Dr. Bob Rotella explains in the title of his recent book, "Golf is not a game of perfect." The notion of getting that stupid white ball in that small hole way off yonder, with tools ill-designed to do so, is a ridiculous proposition at best. However, as frustrating as the game can be, we still keep coming back. It only takes one good shot that gives you the confidence and control over that stupid ball, which keeps you coming back for more. As Kevin Kostner says in the movie *Tin Cup*, "There is no better feeling than a well struck ball."

Well, I am not a pro by any means, but I have on occasion been known to understand a little about this silly game. Nevertheless, I would like to pass on a few tips that have worked for me. These tips suggest ways to approach the game and what key elements are required to successfully pound that dimpled ball straight up the fairway.


Student David Balicki demonstrates a good putting stance.

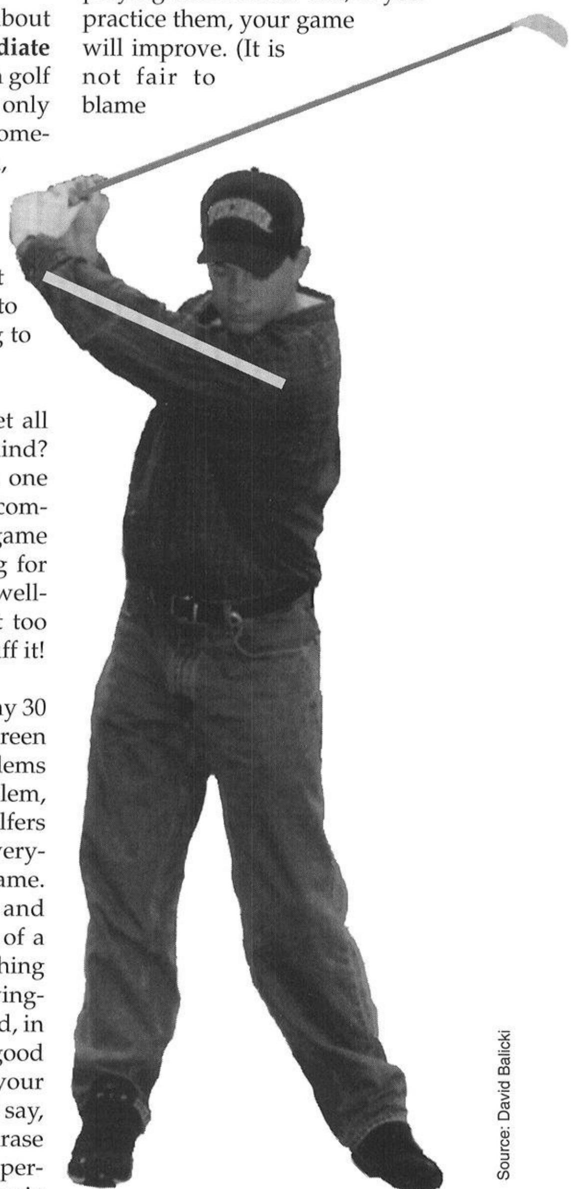
Source: Dan Pierpont

The first thing everyone must know about the game of golf **is not to expect immediate success** by listening or reading random golf tips. If you're like me, your brain can only handle one thing at a time. So when someone says to you, "keep your head down, bend your knees, keep your grip loose, watch the ball and don't swing too hard," you only get more frustrated. Granted these are all excellent tips, but there is no way you are going to remember all these things while trying to swing a golf club.

So how, pray tell, are you going to get all these swing tips ingrained in your mind? The answer is simple: only try to fix one thing at a time. Moreover, I highly recommend that you do not try to fix your game while you are playing. Save the fixing for when you are practicing. It has been well-shown that if you are thinking about too many things at once, you will likely duff it!

Indeed, most people couldn't hit fairway 30 yards in front of them, let alone a little green 200 yards away, while trying to fix problems during their swing. To solve this problem, there is a trick that helps many pro golfers and good amateurs, which can help everyone. The trick is a word association game. Instead of thinking of all those tips and swing hints during your swing, think of a word or phrase that doesn't have anything to do with golf. Then, while you are swinging, say the word or phrase in your head, in order to clear your mind. If you find a good phrase, it should follow the timing of your swing. For example, sometimes I like to say, "iiice crream." You could try a catchy phrase my Uncle uses, "Buuuuud-weiser," or perhaps Kevin Kostner's phrase in the movie *Tin Cup*, "dollar – bills."

Now, work on all those swing tips, like keeping your head down and bending your knees, when you are on the practice range or when you are doing your practice swings. Here are some of the most important golf tips I have learned over the years. Remember, don't expect immediate success by employing these ideas. But, if you practice them, your game will improve. (It is not fair to blame


Source: David Balicki

Author Dan Pierpont keeping his left arm straight at the top of his swing.

on me if your ball knocks out the guy golfing in the group in front of you.)

1. **Making Contact:** Keep your head down and focus on the back of the ball. Don't worry, your friends will watch where it goes. Your head should stay down until your body naturally brings it up with the follow through and rotation of your swing. I've been playing for 12 years, and I still occasionally find myself staring at the stars instead of the ball.

2. **The Full Swing:** If you're like everyone else in the world you want to hit the ball like Tiger Woods. Well, swinging out of your pants will only lead to putting that golf ball through the window of the house strategically placed along side of the golf course. The ball will go just as far if you hit it on the sweet spot (middle of clubhead) with an easy swing. However, if you want that extra distance, one of the secrets to smacking the ball into outer space is to keep your left arm completely straight on the backswing. Bring the club back low and slow, making sure that left arm is straight across at the top of your backswing. Start your downswing with your hips and as they say in *Tin Cup*, "Let the Big Dog Eat."

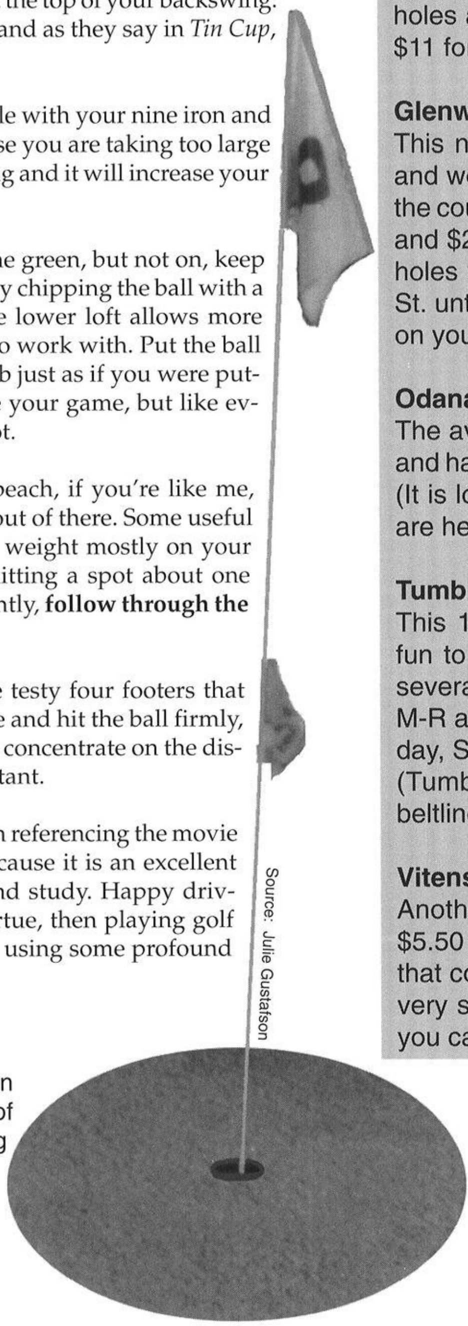
3. **Short Irons:** If you are having trouble with your nine iron and pitching wedge, it is most likely because you are taking too large of a backswing. Shorten your backswing and it will increase your accuracy and consistency.

4. **Chipping:** When you are close to the green, but not on, keep your wrists straight while swinging. Try chipping the ball with a 7, 8 or 9 iron instead of a wedge. The lower loft allows more control when you have a lot of green to work with. Put the ball back in your stance, and swing the club just as if you were putting the ball. Good chipping can save your game, but like everything else, you need to practice a lot.

5. **In the sand:** When you're in the beach, if you're like me, your highest priority is to get the ball out of there. Some useful tips for the sand shots are: keep your weight mostly on your left foot (lefties—right foot), aim at hitting a spot about one inch behind the ball and most importantly, **follow through the ball with the clubhead**.

6. **Putting:** When putting those little testy four footers that make you cry if you miss them, be sure and hit the ball firmly, taking careful aim. On your long putts concentrate on the distance, your aim is not nearly as important.

In case you haven't noticed, I have been referencing the movie *Tin Cup* quite a bit. That is mainly because it is an excellent movie that everyone should watch and study. Happy driving, and remember, if patience is a virtue, then playing golf can bring the most virtuous person to using some profound and inventive expletives.



Source: Julie Gustafson

Author Bio -- Dan Pierpont is a senior in chemical engineering who dreams of golfing in Pasadena, CA after watching the Badgers win the Rose Bowl.

Where to Go Golfing

University Ridge Golf Course
U-Ridge is a very difficult course and is a perfect place for intermediate and advanced golfers. Prices are $20 for 18 holes if you have a student ID. It is a little expensive, but everyone else has to pay $67 a round, so students get a great deal. If you are a beginner, avoid University Ridge Golf Course, there are plenty of other ways to humble yourself, if that is your intention.

Nine Springs Golf Course
A great course for beginners or intermediate golfers. Nine Springs is only a ten minute drive from campus. (Take Park St South–Right on Fish Hatchery Rd– Right on Traceway Dr. just past Dairy Queen—the Golf Course is on your left one block down.) There are 9 holes and total par is 30. Green fees are $6.50 for 9, $11 for 18.

Glenway Golf Course
This nine hole course is a great break from classes and work. Better for beginner or intermediate golfers, the course is challenging but fun. Fees are $11 for nine and $20 for 18. Prices are $8.50 for 9 and $15 for 18 holes with a student ID. (To get there, follow Regent St. until it becomes Speedway, and the course will be on your right after the cemetery.)

Odana Hills Golf Course
The average public course, Odana Hills is fun to play and has reasonable golf fees. It costs $21 for 18 holes. (It is located just off the beltline on your right, as you are headed towards West Town Mall.)

Tumbledown Trails
This 18 hole course is very forgiving and extremely fun to play. There is a taste of everything, including several water holes. Green Fees are $20 for 18 holes M-R after 2:00 pm. and $15 M-R before 2:00 pm. Friday, Saturday, and Sunday fees are $24 for 18 holes. (Tumbledown Trails is located four miles past the beltline on Mineral Point Road, on your left side.)

Vitense Par 3 Golf Course
Another good course for beginners,Vitense is only $5.50 for 9 holes. There is also a large driving range that costs $5.50 for a large bucket of balls. Vitense is very short, so even if you have never played before, you can still score fairly well.

A Bridge to the New Millenium

Engineering Expo has been an ongoing tradition for nearly 60 years. In 1912, the University of Wisconsin Engineers adopted St. Pat as their patron and held a parade in his honor. The parade became an annual event. However, the law students maintained that St. Patrick was a lawyer and, to prove it, harrassed the engineers along their State Street parade route. The parade boasted floats that mocked the law students and their profession. The lawyers answered these insults from the top of State Street buildings with a bountiful supply of rotten eggs.

The feud between the engineers, called the "plumbers," and the lawyers, called the "shysters," became more and more spirited until it burst out into a riot, which sent some students to the hospital and others to jail. The merchants and general populous of Madison demanded that action be taken to prevent future violence. The engineering faculty, sought a means of diverting the students efforts to more constructive activities. In 1940, the first Engineering Expo, put together by the Polygon Engineering Student Council, replaced the parade. It featured about 40 student and 30 industrial exhibits.

In 1956, the Expo expanded under the leadership of a mechanical engineering student, John Bollinger, now the Dean of the College of Engineering. In 1959, Expo was changed to a biennial event. And in 1999 we continue the tradition with the 24th Engineering Expo, Building A Bridge to the New Millenium.

Expo and Industry

Engineering Expo provides a forum for industry, students and faculty to interact. It offers a unique oportunity for corporations to display the current technology that makes them successful in the business world. Corporate exhibits provide the medium for

students, faculty and researchers to explore common technological interests and pursue potential partnerships. Exhibitors at Engineering Expo '97 included companies such as Ford Motor Company, showcasing the Ka "New Edge" design concept, Mach III (Mustang Concept), GT90 exoticar and many other automotive innovations. General Electric displayed products from its various businesses, including aircraft engines and medical systems. Silicon Graphics featured high performance visual computer systems for applications such as CAD, CAM, computational analysis and virtual prototyping. General Motors demonstrated advanced stereo equipment and a 1997 Corvette chassis. Rockwell Avionics & Communications displayed leading edge global positioning satellite (GPS) technology, microelectronics and aircraft technology.

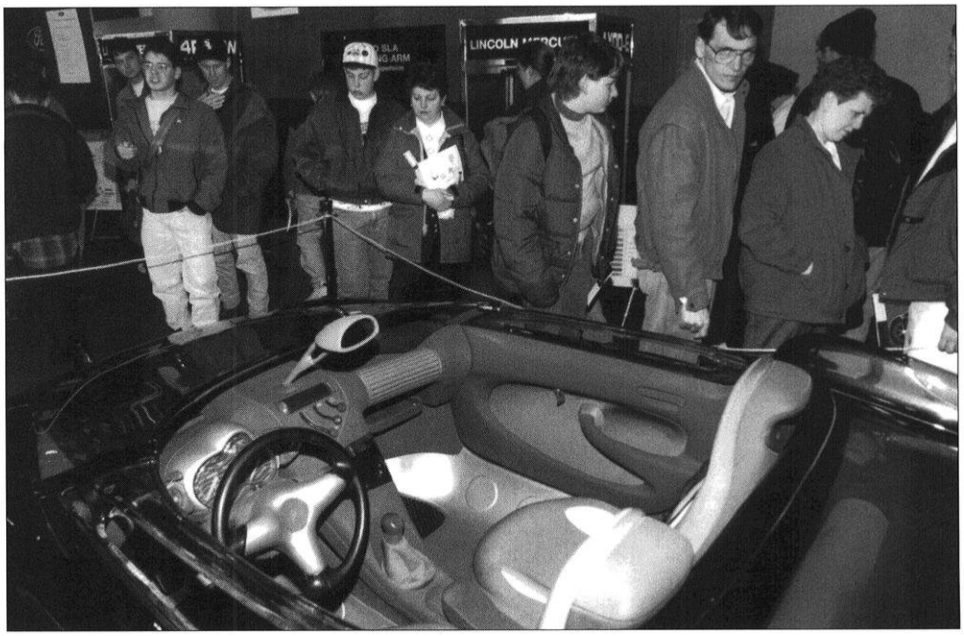
"St. Patrick was an Engineer" (1928)

Industrial exhibits allow the public a chance to take a glimpse of the future by exploring the new technological advances that await everyone. How will our lives as users change due to these technologies, improving our quality of life? What can we expect to see in our homes, schools, hospitals and autos due to the technology at Engineering Expo?

Student Participation in Expo

Student projects lie at the heart of all exhibits in Expo. The student exhibitors give to Expo in a very crucial and multifaceted way: by sharing their research with others. Students and organizations do this through their creativity and motivation to succeed. In addition to competing in the student exhibit competition, the students are able to demonstrate the course materials they learn in class, develop their teamwork and communication skills and show off their creativity. Individual exhibits in Expo '97 included the Urilet, a new bathroom fixture with all the benefits and conviences of a urinal and the aesthetics and functionality of a well designed toilet. Another exhibit demonstrated corrosion fatigue modeling via differential infared thermography, and showed how to detect temperature pertubations created by material defects in response to dynamic heating.

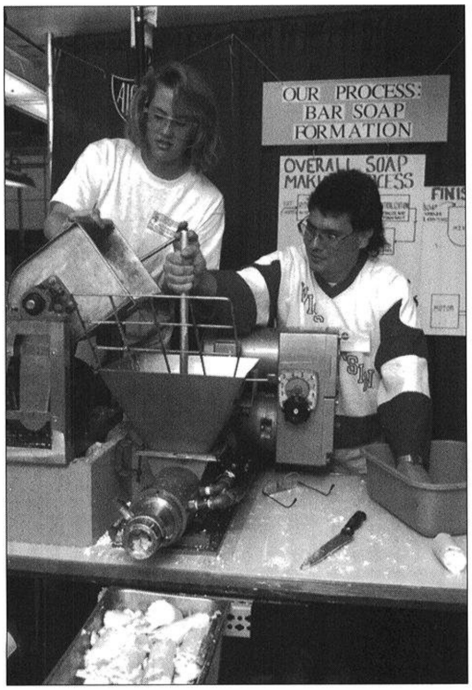
Student organizations such as ASCE displayed the concrete canoe, designed and built in the College of Engineering. Team Paradigm gave people a peek into the world of hybrid electric vehicles and zero emissions. AIChE demonstrated the process of making marshmallows in industry. The LEGO Campus demonstrated an engineer's passion for perfection through a scale model of the entire College of Engineering and neighboring areas. The public and students got a glimpse of the proposed Engineering Centers building, to be located on the corner of University Avenue and Breese Terrace. With these exhibits, and many more like



them, Engineering Expo '99 promises to bring out more of the best that tomorrow's engineers have to offer.

K-12 Participation in Expo

The K-12 students of today are the engineers of tomorrow. Expo has always recognized this and, since 1953 has invited pre-college students to participate in Expo. The opening day of Expo, known as Students' Day, will see thousands of students from across the state of Wisconsin make a major contribution to the success of Expo. Numerous events are proposed to the students to partake in, such as the Bridge Building competition which showcase high school teams' abilities to design a bridge that can withstand extreme stress. The winning bridge is the one with the highest strength, lowest weight, lowest "cost," best aesthetics and best report. In the Rube Goldberg™ competition, high school teams build machines that harness different type of energy to accomplish a simple task in the most difficult manner pos-



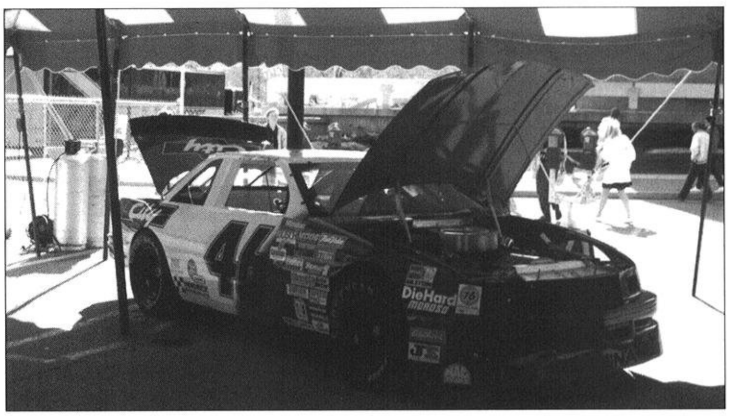
sible. Students can demonstrate their understanding of aerodynamics in the Model Rocket Competition. Student teams in grades 6 to 12 design and build model rockets using materials from a standard kit. The winning rockets are those with the smoothest launch, longest time aloft, and gentlest landing. In the Egg Toss Competition, individual K-8 students must devise a way to throw an egg over a volleyball net and hit a target, without breaking the egg. The students create egg-protecting containers using recyclable materials such as milk jugs, corrugated cardboard or newsprint. Expo's exhibits provide K-12 students an opportunity to discover how engineers use fundamental math and science principles to develop today's cutting-edge technology.

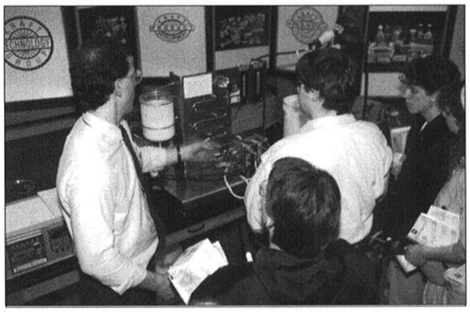
Robomania

In April of 1995, the first Robot Triathlon was held in the lobby of the Mechanical Engineering building. Only four competitors managed to construct a robot in time for Expo. Despite the small number of competitors, the first ever Robot Triathlon drew the biggest crowd at Expo '95. Originally conceived to fill extra space in the lobby of Mechanical Engineering, the triathlon has grown into the most anticipated event at Expo.

The triathlon of Expo '97 featured a Robo Ball tournament, the Maze of Confusion and the Obstacle Course of Disaster. With more than $15,000 in prize money at stake, the triathlon drew more than 38 competitors from all around the UW campus.

Expo '99 will feature a new competition, called RoboMania. The objective of this event will be to play another robot in a soccer match. Robots may use reasonable force, as determined by the referees, in order to recover the ball from the opponent. Points will be awarded for each goal, and bonus points will be awarded for winning the match. Awards will be handed out for first through sixth place in the RoboMania competition as well as an aesthetics competition.

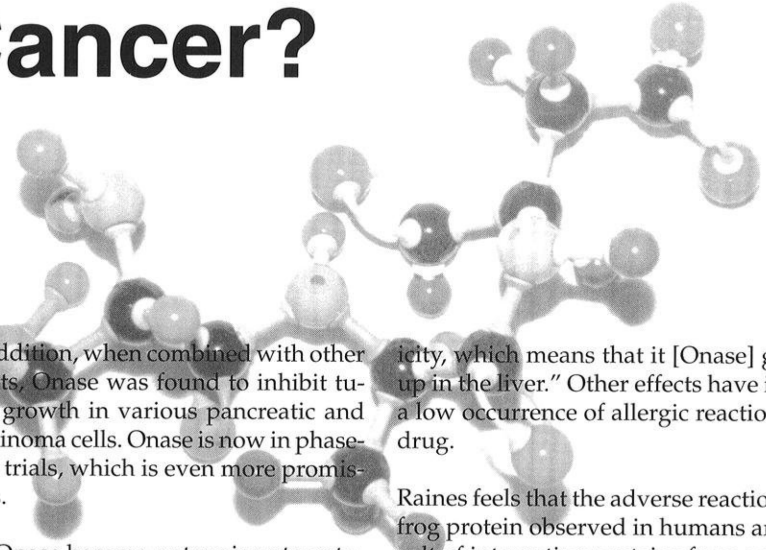




This event demonstrates an engineers ability to problem solve in engineering disciplines they may have little experience, or while under the pressure of a big competition in front of hundreds of on-lookers.

Compiled from past Engineering Expo literature by Matt Bruehl. For more information on Engineering Expo '99, email: expo@cae.wisc.edu, or check the website: http://www.cae.wisc.edu/~expo

A Cure For Cancer?



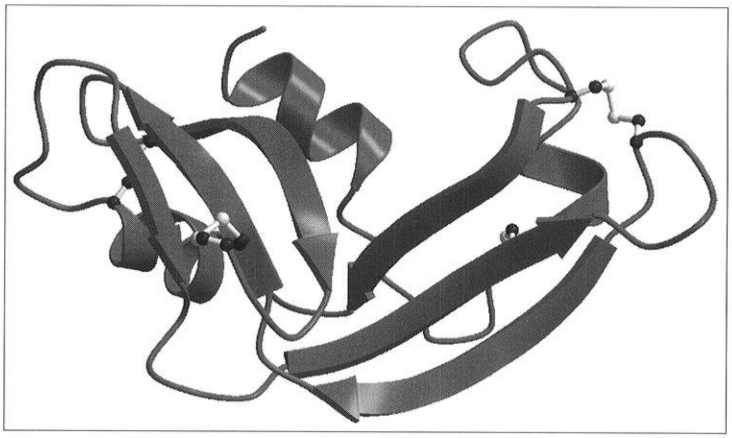
In 1991, scientists discovered that a ribonuclease protein (Rnase) in the Northern leopard frog was an effective cancer killer. This find, credited to Alfacell Corporation and dubbed Onconase (Onase), has leapt to the forefront in the treatment of various forms of cancer. This has prompted hopes that similar proteins in humans can be manipulated to do the same. After working with Rnase in bovine, a close "cousin" to the human version, researchers found a strain of Rnase that avoids healthy cells and destroys cancer cells. It seems that an effective human version of this cancer killer is not far off.

When the Alphacell researchers isolated Onase, little was known other than the selective diet of the ravenous protein. Onase is a ribonuclease protein (Rnase), an assortment of enzymes that cleave RNA (a nucleic acid that controls chemical activities). Rnase essentially alters a cell's RNA and prevents its protein synthesis. There are Rnase Inhibitors (RI) inside every healthy, non-cancerous cell in an organism, which prevent Rnase from binding to the cell and killing it. However, cancerous cells don't have effective RI and may even have unique receptors that bind more tightly to the Rnase. These receptors make cancer cells easy targets for the hunting protein molecules.

It seems that an effective human version of this cancer killer is not far off

Alphacell Corporation thought that if Onase could track down and stop cancer cells in frogs, it do the same in humans. Thus, the biotechnology firm began testing the frog-derived protein on human cancer patients. Bingo! They found Onase to be promising in treatment of malignant mesothelioma, an asbestos-related cancer. Specifically, South West Oncology Associates site, "Onconase has demonstrated about 40% greater activity against this type of cancer (than doxirubicin, a typical treatment for mesothelioma) as shown in previous studies." In addition, when combined with other treatments, Onase was found to inhibit tumor cell growth in various pancreatic and lung carcinoma cells. Onase is now in phase-3 clinical trials, which is even more promising news.

In 1991, Onase became a stepping stone toward manipulating human Rnase to kill cancer. Later that year, UW-Madison biochemist Ronald T. Raines, while comparing Onase to Rnase, found in mammals, gave the impetus and announced that a "cousin"of the frog protein in mammals had some cancer-fighting potential. Raines found that Rnase A, a digestive protein made by the pancreas, could be genetically altered to become a cancer killer. The biologist had looked to cows for the answer, and, apparently, had received his "bovine inspiration."



Onconase, the ribonuclease in Phase III clinical trials.

Raines knew that, since cow Rnase is very similar to human Rnase, successfully manipulating the cow protein to fight cancer would make it easier to do so with the human strain. Comparing Onase with bovine Rnase, he found that they differ in their affinity to bond with RI. The frog Rnase has much less RI affinity than the bovine strain, freeing it up to bond to cancer cells. With this in mind, Raines developed two strains of bovine Rnase that proved deadly to cancer in the laboratory. Raines found that it was relatively easy to convert the cow protein into a cancer killer; only one of 124 amino acids that make up the protein need be altered to allow the Rnase to evade the RI.

While human trials have not begun for bovine Rnase, Onase has shown few side effects. Raines notes, "There's some renal toxicity, which means that it [Onase] gets held up in the liver." Other effects have included a low occurrence of allergic reactions to the drug.

Raines feels that the adverse reactions to the frog protein observed in humans are the result of integrating proteins from animals as genetically different from frogs. He speculates that the renal toxicity is an immune response. Dr. Paul S. Ritch, a professor of medicine in the division of Hematology/Oncology at the UW-Madison, echoes Raines, suggesting that the allergic reactions relate to the bodies unfamiliarity with Onase. "It's a foreign protein; there's a finite incidence of allergic reactions to it."

These unfavorable reactions to Onase are problems that would likely be eliminated by a successful human Rnase. Cancer-killing human Rnase would be tailored specifically for the human body and should have the highest possible therapeutic index, a measure of the ability of the protein to kill a cancer cell versus a non-cancer cell. In other words, the protein would spare healthy cells, preventing the allergic reactions and renal toxicity of Onase, suggestive of a high therapeutic index. In addition, the strain would avoid the problems with "...traditional methods of cancer chemotherapy, which can cause nausea, vomiting and weight loss," suggestive of a low therapeutic index.

CANCER continued pg 15

Nine Pictures, 150 years

Written by: Victor Chen
Photography by: Leo Chen

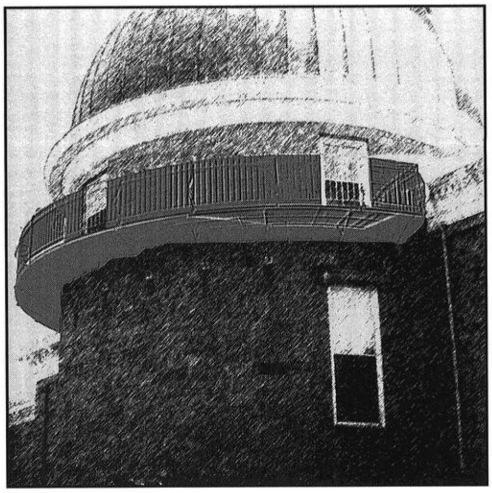
By now, everyone in Wisconsin has heard about the state's 150th birthday. From celebrations dating back to the beginning of the year and highlighted license plates to the state's name finally being pronounced correctly by just about everyone, Wisconsin's sesqui centennial was an event worth celebrating.

It occurred to me, as I was walking through UW-Madison campus, that the school was also celebrating its sesquicentennial. The idea of walking from one class held in a building that was built in the 1990's to another class held in a room which students used 150 years ago intrigued me. Because the history of this school is so rich, it is impossible to describe the annals of UW-Madison in a few short paragraphs. But in an effort to enrich your knowledge of the campus thousands of people tread across each day, this photo essay of the nine letters and 150 years of Wisconsin was shot and written. Enjoy.

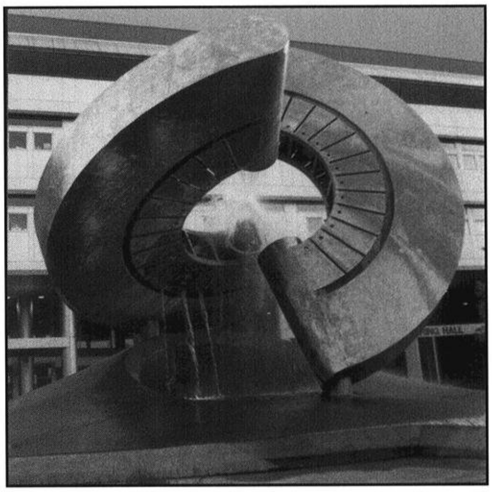
Watching over the village of Madison in 1848, "College Hill" became the birthplace of the University. It began with North Hall in 1851, where 56 students could eat, study and sleep, and continued later with South Hall (1855) and Main Hall (1859). In the words of the University Regents in 1860, "...it (Main Hall) is a structure...fitted to be what it was designed to be, the central point of educational interest in Wisconsin for generations yet to come." Built from sandstone that came from a quarry two miles west of campus, one of Main Hall's permanent features was a great dome resting on an octagonal drum. Unfortunately, a fire destroyed the dome in 1916, which most of the University's 4800 students and city firemen tried to save. Since 1909, a bronze statue of Abraham Lincoln has been gazing over the city of Madison in front of the building now known as Bascom Hall.

In a place where college proms, submarine detection tests and boxing matches once took place, the old Red Gym is still one of the most unique buildings on the Wisconsin campus. Built in 1892 as a combination gymnasium and armory, military drill rooms, bowling alleys, a swimming pool, a 440 yard running track and a basketball court were among the many features of the Red Gym. From hosting the 1902 and 1904 Wisconsin Republican Conventions and holding packed houses for Big Ten basketball games to its firebombing in 1970, the Red Gym has definitely had its ups and downs. But, after being added to the National Landmark Registry in 1993, the building will always stand tall on the shores of Lake Mendota. Students will soon be able to relive history when it reopens in the school's 150th anniversary.

Sterling Hall, built in 1915 as the home for physics, political economy and commerce, did not always look as nice as it does today. During the Viet nam War protests in 1970, a bomb of ammonium nitrate and fuel oil exploded in this building in an attempt to destroy the Army Mathematics Research Center. A blast that ripped through the walls of Sterling Hall, the bomb killed one postdoctoral student and injured three others. Ironically, the bomb did very little damage to its intended target. Twenty-eight years after this devastating explosion, and 83 years after it was first built, the physics and astronomy departments now reside in a building that remains in "sterling" condition.



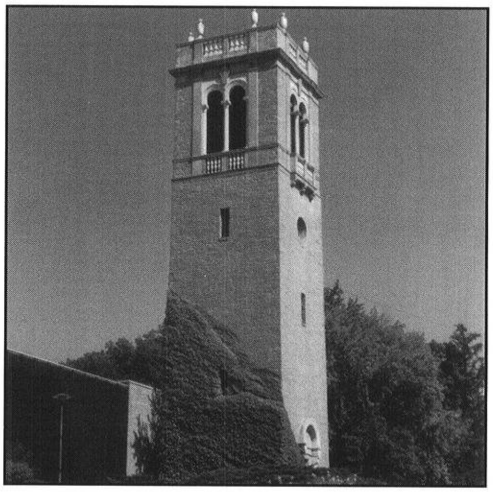
Constructed in 1877, no one knows for sure what exactly intrigued ex-governor C.C. Washburn to push the creation of the University's first donated building. Perhaps it was the University Regents in 1869 that said no institution of higher learning could aspire to the status of a university without an observatory. However, whatever sparked Washburn's interest in astronomy has resulted in one of the University's most treasured buildings. A fully equipped observatory, including a telescope which was specified to be larger than the 15-inch refractor at Harvard, Washburn Observatory housed the third largest refractor in the country at that time. Although the observatory's use has declined since 1959, the old observatory still remains open to the public. You can visit the old observatory on the first and third Wednesdays of each month (weather permitting) honoring a request by C.C. Washburn himself.



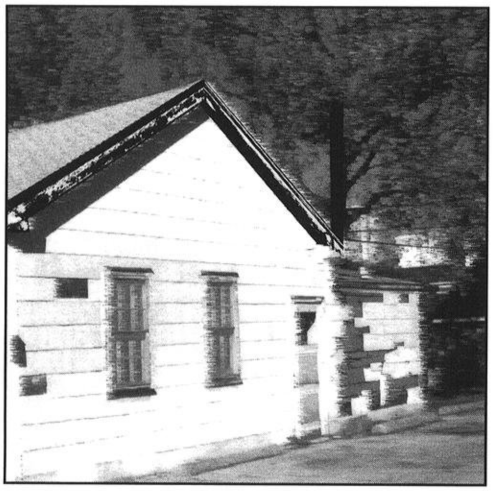
On the engineering campus stands one of the newer university landmarks. Maquina, or "the machine" in Spanish, was designed by William Conrad Severson, an alumnus of the University. Standing 18 feet high, this fountain sculpture is just a small part of a dynamic system that will eventually include water as a liquid, vapor and solid along with compressed air, sound and light. The fountain and mall on the engineering campus were dedicated to the future students in 1994 because "the mall is not only an artistic image for the college, a place to sit and talk or study, but a project facility," as put by Dean J. Bollinger. Each semester, students have the opportunity to work on this ongoing project which will someday become another historical UW landmark.

November weather: snow on the ground, wind swirling, people bundled in their red and white scarves, hats and mittens. It's Saturday, and students and fans begin filing through the arch which guards the path to historic Camp Randall Stadium in anticipation of another Badger victory. But almost 140 years ago, football players were not running or passing plays being run on this particular plot of land. In 1861, the Wisconsin Agricultural Society had just given this land to the government for a military training center, where more than 70,000 troops attended training drills. After the Civil War, the state presented the site to the University as a memorial athletic field and in 1913, Camp Randall Stadium was built at its current site. Four years later, the Badgers defeated the Minnesota Gophers 10 to 7 in their inaugural game at Camp Randall.

Sitting at the corner of Observatory and Babcock Drive lies a collection of 22 different gardens and the University's largest outdoor classroom. Through many donations and gifts, including a substantial gift from Ethel Allen, the widow of UW-Madison bacteriologist Oscar Allen, this instructional garden was born. In 1987, the gardens were dedicated and named the Allen Centennial Gardens in honor of the Allens and the 100th anniversary of the College of Agricultural and Life Sciences. Today, classes, including entomology, plant pathology and even art classes, come to the gardens to learn from the myriad species of plants.



In 1916, when the dome of Bascom Hall burned down, the Class of 1917 decided that the funds collected for their graduation gift should be used to purchase bells for the anticipated reconstruction of the dome. Every class afterwards through 1926 contributed towards this fund, but by 1932, there were no more plans for a new dome. Since the fundraising had been so successful, it was decided that a set of carillon bells and a tower in which to hang them would be purchased. Construction on this 85-foot sandstone tower began in 1934, and the first 25 bells were dedicated during Commencement Weekend of 1936. Since then, a mechanical player which can ring the hours and 31 bells have been added, bringing the carillon's range to four and one-half octaves, and its weight in bells to tens of thousands of pounds.



Nearing the end of the millennium, the end of this little building is also in sight. Formerly known as T-21, this structure was built along with many other temporary buildings during the summer of 1947. Once a cafeteria, the remains of a grease fire set by a new hamburger machine are still standing at 1545 University Avenue. Currently, it is the home of several engineering student organizations, including the Wisconsin Engineer magazine. However, T-21 will soon be a building of the past when it is torn down and becomes the location of the Engineering Centers Building.

And thus ending our photographic tour of the UW campus, we hope that the next time you walk to your class, you take some time to ponder what historical events may have occurred in the very places you see day to day. Sure, the education, the activities and sports teams make this university a great place, but its rich history reassures us that when you've said WIS-CON-SIN, you've said it all.

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R.C. Bless, Washburn Observatory
Dean J. Bollinger - Email
Jim Feldman - Phone interview and his book, The Buildings of the University of Wisconsin
Robert E. Gard - University Madison - U.S.A.
The Daily Cardinal, September 16, 1998

Author Bio: Victor Chen is majoring in Chemistry and Chemical Engineering. Leo Chen would like to go into film.

CANCER from pg 10

While a human version of the cancer-killing frog protein does not exist, it seems to be just a hop away. Raines reminds us, "The ribonuclease from cows and even more importantly from humans have all the essential ingredients necessary for them to kill cancer cells." First there was the frog protein Onase, AKA cancer killer. Now there is "cow chemo." Next, we may have the fabled "cure," a-mean-ol' cancer killer!

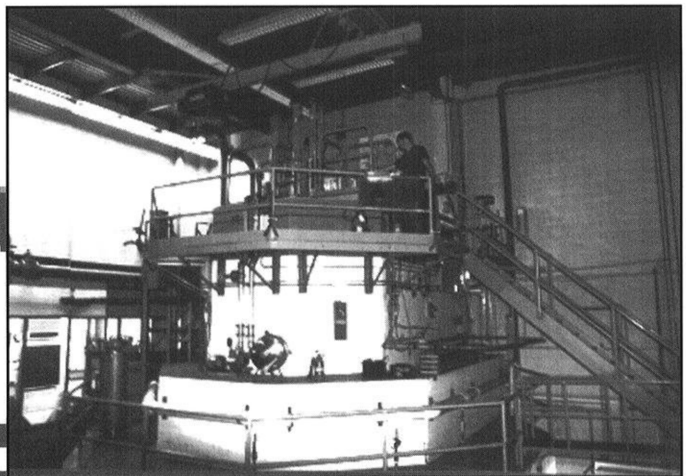
Author Bio: Ethan Erickson is an aspiring engineer with a passion for rock Climbing.

UW-ANS Named Best Student Branch

The UW-Madison student branch of the American Nuclear Society (ANS) has made a promising start to the semester. The local chapter of ANS was recently honored with the1998 Samuel Glasstone award for Best Student Branch. The Student Branches Committee, responsible for selecting the award's recipient, stated that the local ANS chapter "reflected the energy and professionalism that has made UW-ANS a model for student branches across the country." Along with praise from the Student Branches Committee, the society was presented with a $600 cash award.

Student branches of ANS from across the country competed for the Glasstone award by submitting reports of their yearly activities. With the main goal of promoting nuclear science and technology, the UW-Madison student branch of ANS described its activities for the year in seven categories: public information, community and public service, university service, professional development, ANS/nuclear industry support, social events and section management.

Identifying itself as a community resource on nuclear technology, UW-ANS is very active in public information services. Perhaps the most notable service provided by ANS is the UW-Madison Nuclear reactor tour. The tours allow visitors to learn about nuclear reactors and radiation. A better understanding of nuclear fusion can be obtained by touring the Pegasus fusion reactor research device, which is supported almost completely by the student labor of ANS members. The local branch of ANS also offers information to the public by its participation in Engineering Saturday for Tomorrow's Engineers at Madison (ESTEAM), an outreach program designed to inform high school juniors and seniors about the opportunities of UW-Madison's engineering curricula. By offering informative talks at area schools and to local boy/girl scout troops, ANS provides information about nuclear technology to younger community members.


Source: Mark Croft

Crowell and Utschig monitoring the reactor.


Source: Mark Croft

1997-98 ANS president Jeffrey Crowell and 1997-98 ANS public information officer Tris Utschig shown with Glasstone Award.

ANS also feels the need to serve the community in ways unrelated to nuclear technology. By sponsoring the College of Engineering Spring Blood Drive and winning the highest member participation award 11 out of the last 13 blood drives, the UW-Madison student branch of ANS has demonstrated a commitment to community service.

At the university level, ANS takes pride in its involvement in student government and the open houses and organization fairs it sponsors. Additionally, the Student Branch President selects an undergraduate and a graduate student to serve as student-faculty liaisons in an effort to increase the voice of students in departmental decisions. Also, in an effort to enhance the quality of graduates from the Department of Nuclear Engineering, ANS is compiling an "Opportunity Info-Bank" of available scholarships, grants, internships and other opportunities.

The American Nuclear Society's interest in fostering professional development extends directly to its members during the monthly meetings and an annual off-site tour. To Providing support to the American Nuclear Society on a national level and within industry are important to the local ANS branch. In an attempt to learn more about national organization operations, five UW-Madison students served as session assistants at the

The local ANS chapter "reflected the energy and professionalism that has made UW-ANS a model for student branches across the country"

1997 Fall Meeting in Albuquerque, New Mexico. Plans are also in the works to encourage members to address real-world issues through a problem-sharing project with the Byron Plant ANS branch.

For the local branch to provide all the services, its members must work well together. To maintain good group dynamics, ANS recognizes the importance of bringing its members together in a social setting. After every meeting, members enjoy a social hour, and each semester an intramural volleyball team of ANS members is organized. The picnics sponsored twice a year by the society are unique to UW-ANS. Known as the Pic-Nuke, these gatherings serve as enjoyable ways for members to get to know other students and faculty members in a social setting.

The local chapter of ANS hopes to build stronger relationships with those outside the society

The local chapter of ANS hopes to build stronger relationships with those outside of the society. Through successful section management, UW-ANS has effectively opened the lines of communication to the rest of the College of Engineering and to the community in general. This connection has been establisheJàand continued through the production of a continuously updated electronic newsletter, bulletin board postings located in the Engineering Research Building and the maintenance of a web-page available at http://ans.neep.wisc.edu/~ans. These resources allow the public to have a greater understanding of the goals and opportunities associated with the UW-Madison branch of ANS. Society members also enjoy fielding questions regarding ANS or nuclear technology in general because, as the local ANS president Tris Utschig stated, "It's rewarding to get to talk about nuclear power."

With this kind of enthusiasm for their field of study, it is easy to understand why UW-MacÉ on ANS members have been successful. Demonstrating an interest in serving its members and the general public, the UW-Madison chapter of the American Nuclear Society has secured its place as a community resource. By continuing to excel in their endeavors, the members of ANS may quite possibly be honored with the Samuel Glasstone award again in the future.

A special thank you is extended to Tris Utschig, current president of UW-ANS, for his help in preparing this article.

Author Bio: Tanya Kosmo is a junior majoring in mechanical engineering.

WIStube

Shocking Research in Alternative Energy

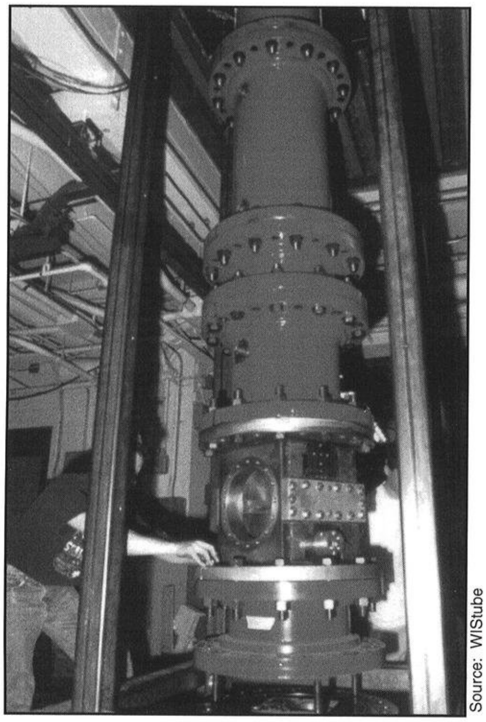
As a metallic 'chung' echoes through the basement of the Engineering Research Building (ERB), graduate students scramble to record data on the Mach 2 shock wave they have just produced. The graduate students are not just making noise. They are assisting in the research on an energy source for the future. Several professors in the College of Engineering (COE) have collaborated to explore aspects of a new energy source called Inertial Confinement Fusion (ICF).

ICF is a safe and environmentally friendly energy alternative to the growing worldwide usage of non-renewable fossil fuels. Simply stated, ICF is fusion, under high amounts of energy, of two different atoms. The fusing of these atoms causes a miniature thermonuclear explosion that gives off enormous amounts of heat. Harnessing the heat produced in this reaction and using it to run steam turbines will produce nearly one million times the energy of burning equivalent amounts of oil.

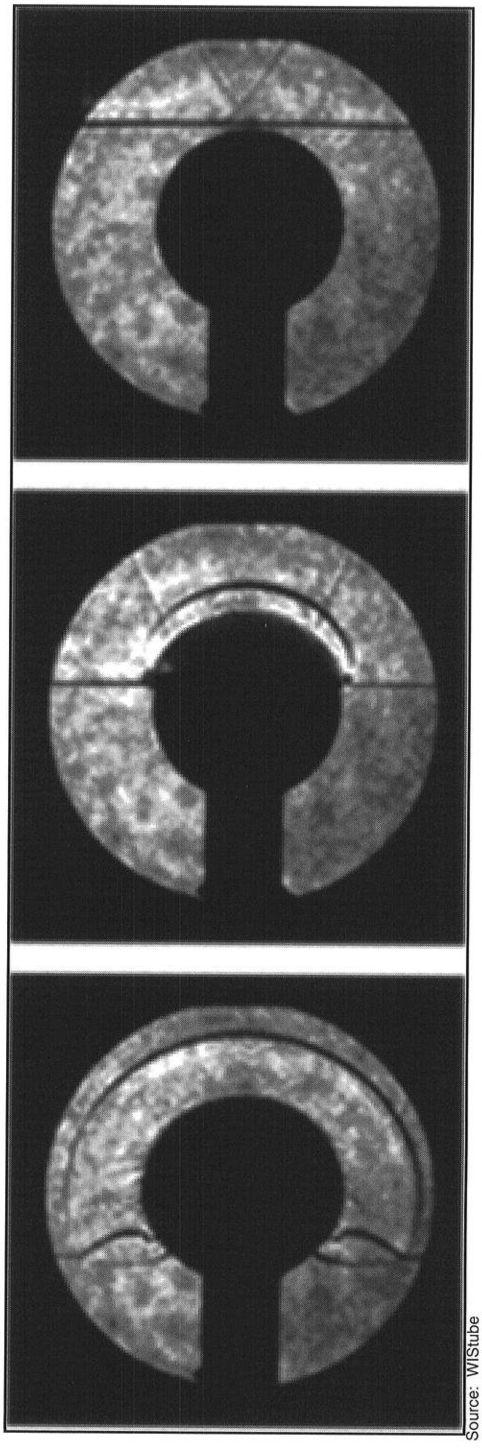
Unfortunately, there are still numerous problems with the procedure of fusing these atoms. Professor Riccardo Bonazza and his staff at the UW-Madison are one of the groups focusing on finding a remedy for ICF's problems. Bonazza's group is most concerned with the effect shock waves have on mixing of the ICF fuel during fusion. To quantify the impact effects of the shock wave on these gaseous interfaces, a new vertical shock tube has been constructed in the basement of the ERB.

The shock tube in the ERB is not the first of its kind, but it is by far the largest and most dynamic currently in use. The WIStube is made of carbon steel, with an outside diameter of the tube is 18 inches. Standing a prominent 30 feet, the WIStube spans 3 floors from the basement to the second floor. Although cylindrical on the outside, the inside is constructed of stainless steel, is 10x10 square inches. In addition, the inside walls are very smooth to prevent multiple shock refractions as the initial shock wave travels down the tube.

The tube consists of two main sections: the driver section and the driven section. The driver section on top of the tube is where shocks are produced. The driver has the



Source: WIStube



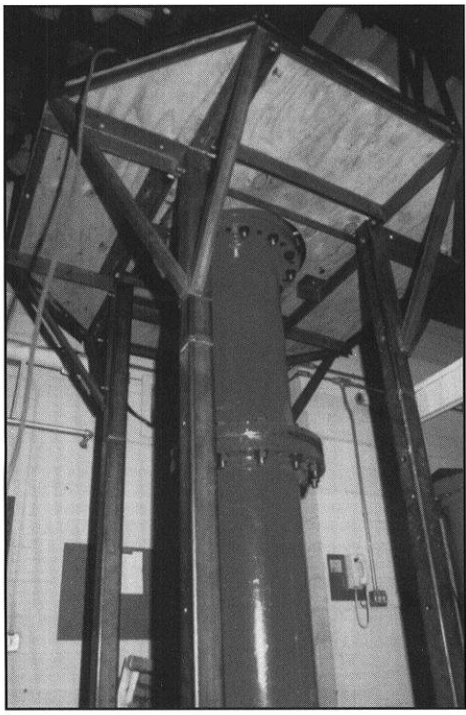
Source: WIStube

On the left: Students on the ground level are securing the test window. The test window holds the quartz windows and is where all the photographic data is taken.
On the right: (Schlieren Series) These three schlieren time series photographs show the propagation of a 1.85 Mach shock wave as it passes over a cylinder in the test section of the tube. The dark line is the primary shock wave and the lighter lines are the reflections off of the walls of the tube. The pictures span approximately 0.09 milliseconds and transgress top to bottom.

structural capacity to withstand pressures up to 100 atmospheres and is designed to create shocks either by combusting a mixture of oxygen and hydrogen or by simply pressurizing the section. The shock tube is robustly designed for strong shocks into atmospheric air and is capable of generating as high as a Mach 5 shock wave. The shock is then released by rupturing a steel diaphragm located between the driver and driven section.

The shock tube is robustly designed for strong shocks into atmospheric air and is capable of generating as high as a Mach 5 shock wave

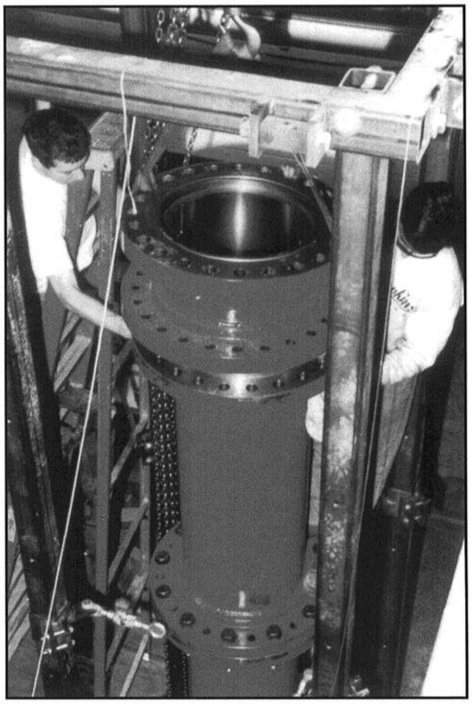
The driven section of the tube is made of nine segments of different lengths. Two areas of very special interest in the driven section are the interface and test section. In the interface section a very thin membrane of nitrocellulose separates gases of different densities. This membrane is held in a 'sandwich' frame which, in turn, is placed in the interface section. The membrane creates a very crisp, nearly invisible interface between the two gases. Pressure transducers located along the driven section are used to calculate the speed of the shock wave as it travels down the tube.


Source: WIStube

A crow's nest was installed to enable access to the third story of the tube. This is the driver section where the diaphragms are changed between each test.

At the bottom of the tube resides the test section, which contains a pair of fused silica viewing windows that provide optical access to the interior of the shock tube. The windows are 3.5 inches thick in order to withstand high pressures during the tests. Optical diagnostics include Rayleigh scattering, Planar Laser Induced Fluorescence, schlieren and shadowgraphy. For schlieren experiments, a laser beam passes through the quartz windows onto a screen. The transmitted light is sensitive to density gradients in the test gas, and these gradients are revealed through dark lines on the screen. A digital camera records the images of the shock wave and the gas interface as they pass by the window. Another related ICF study being conducted is shock diffraction on a cylinder, and a time series of photographs is given in three-step pictures shown. The initial shock is Mach 1.85 in atmospheric air and is seen as a horizontal line. The reflected shock off of the cylinder's surface is seen as a dark arc moving radially away from the cylinder.

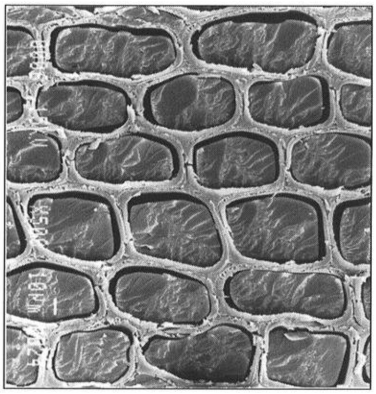
This research will help us understand the physics involved in the Inertial Confinement Fusion process. Specifically, two research areas being studied, with the aid of the WIStube at UW-Madison, are the shock diffraction and shock-interface interactions. The shock diffraction study will provide useful information to design the cooling tubes for ICF reactors, while the shock-interface interactions will provide insight on the mixing between the fuel and the shell that contains it. The actualization of ICF is still many years


Source: WIStube

The 500 lb sections of the tube had to be lifted with a crane during construction. It is the high strength of the WIStube that sets it apart from other shock tubes.

down the road, but it's the efforts of today's researchers who make these new age possibilities a reality.

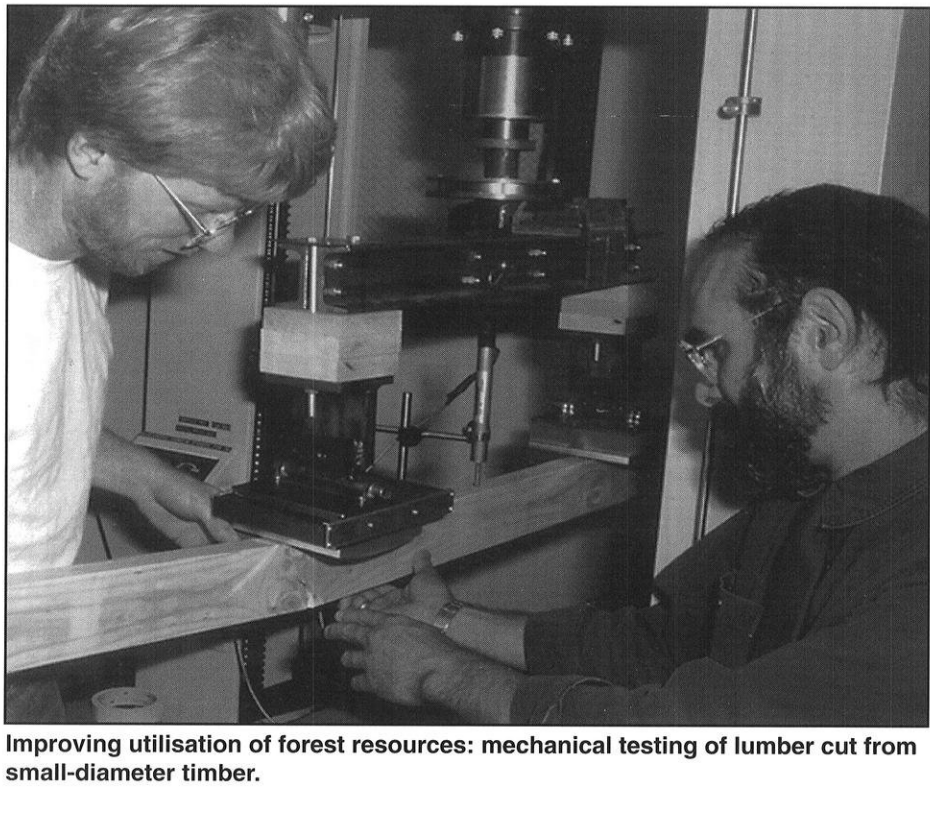
Author Bio: Graham Munson is a junior in Mechanical Engineering.



Wood is an engineering material?

Wood is an engineering material. This composite of cellulose in a lignin matrix is known to most of us as the 2x6's in our house and the chairs for our dinner table, but wood has been used for millennia as a primary material for household articles, high-performance tools, musical instruments and even airplanes. Wood has a high strength to weight ratio, excellent toughness, holds fasteners well and is plentiful, inexpensive and renewable. In addition, it sequesters the carbon dioxide that leads to global warming. Wood is also durable — as a 1000 year old temple in Kyoto, Japan and the U.S.S. Constitution can attest. Its high strength to weight ratio led Howard Hughes to build an entire airplane, the Spruce Goose, from it. The Tacoma Dome has a 530 foot clear span roof , is 157 feet tall, and was built using a computer designed structural system that allowed the use of readily available structural components, including 414 glulam beams.

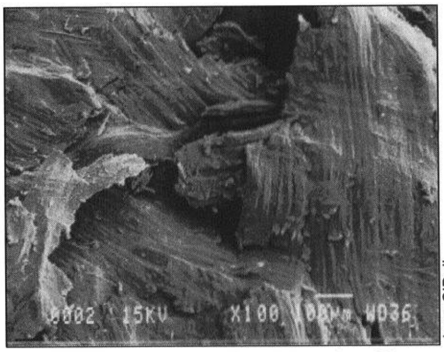
In the 20th century, the predominance of wood in the U.S. was challenged by petroleum derived plastics and steel. Engineers who designed products often chose materials other than wood because either designing with wood posed special problems or because the business mentality of more, cheaper, faster led to the use of machines and unskilled labor. In traditional societies, wood and its applications relied on a trial and error approach to design. Wood is anisotropic; its properties depend on the direction in which the force is applied. In the hands of a skilled craftsman, each piece of wood can be exploited for its strength and beauty. It is cheaper in our society to roll out steel by the mile and injection mold plastics than it is to individually cut and select wood in order to take advantage of its natural properties. It is a choice we make as individuals and as a society.



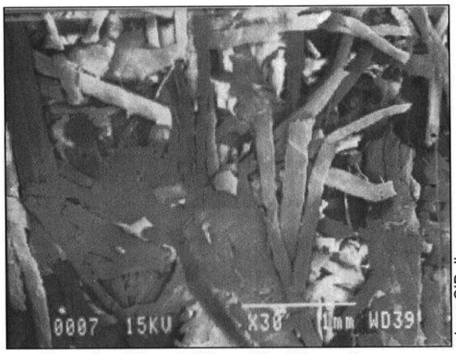
Improving utilisation of forest resources: mechanical testing of lumber cut from small-diameter timber.

Wood has its drawbacks. Some might say fire is the greatest problem for wood, but wood beams perform better in fire than steel. The yield strength of steel decreases dramatically as temperature increases. Large beams char on the outside and reduce their burn rate while retaining their strength. Decay can also be a problem, but wood kept dry will last almost indefinitely. From an engineering standpoint, the most challenging aspect of designing with wood is its swelling and shrinkage in response to changing moisture conditions. Research has developed treatments to reduce moisture uptake, reduce flammability and improve decay resistance of wood.

In 1910, the Forest Service, recognizing the important role of wood, established the Forest Products Laboratory (FPL) in Madison (now located at the west end of campus near the WARF building) as the first institution in the world to conduct systematic research on wood utilization. One of the first fruits of that research was the creosote treatment of railroad ties. This treatment increased the useful life of ties from 3 to 5 years to 10 to 20 years, which cut the need for wood for the railroads by at least half. Considering the huge demand for timber for ties and the clearcutting of forests across the upper midwest to feed this need, this treatment was no small feat. Around World War II, FPL contributed to the war effort with engineering analyses of shipping crates, airplane wings and glue-laminated structures for the Navy. Treatments to improve wood's dimensional stability were pursued after the war and resulted in treatments called impreg and



Jane O'Dell



Jane O'Dell

Scanning electron micrograph of hot-pressed agricultural fiber that has been modified to have thermoplastic properties. For comparison, the photo on the right is unmodified fiber.

compreg. By treating veneers with phenolic resins and hotpress curing them, the resulting composites had outstanding resistance to moisture and heat. Also, the composites were used for sheetmetal patterns in the auto industry and patterns for casting in foundries. The building that now houses Materials Science was the first permanent home to FPL, and a plaque commemorating that can be found on the wall on the lower floor of the building.

Worldwide, wood is researched as an abundant renewable source of material, not only for lumber and veneers, but also a source of chemicals. By reducing the size of wood to fibers, chips and particles, and reassembling with resins and adhesives, the resulting composite becomes isotropic, uniform and predictable. Kitchen countertops are paper-based materials — cellulose fibers in a phenolic or melamine resin matrix. Recently, paper and wood fibers have been used to reinforce thermoplastic resins, adding stiffness, reducing weight and polymer use ($0.06 to $.50 per pound as opposed to $0.75 to $1.00 per pound for the plastic) and creating a unique color and texture. With the addition of a coupling agent, the hydrophilic fibers are compatibilized with the hydrophobic resin.

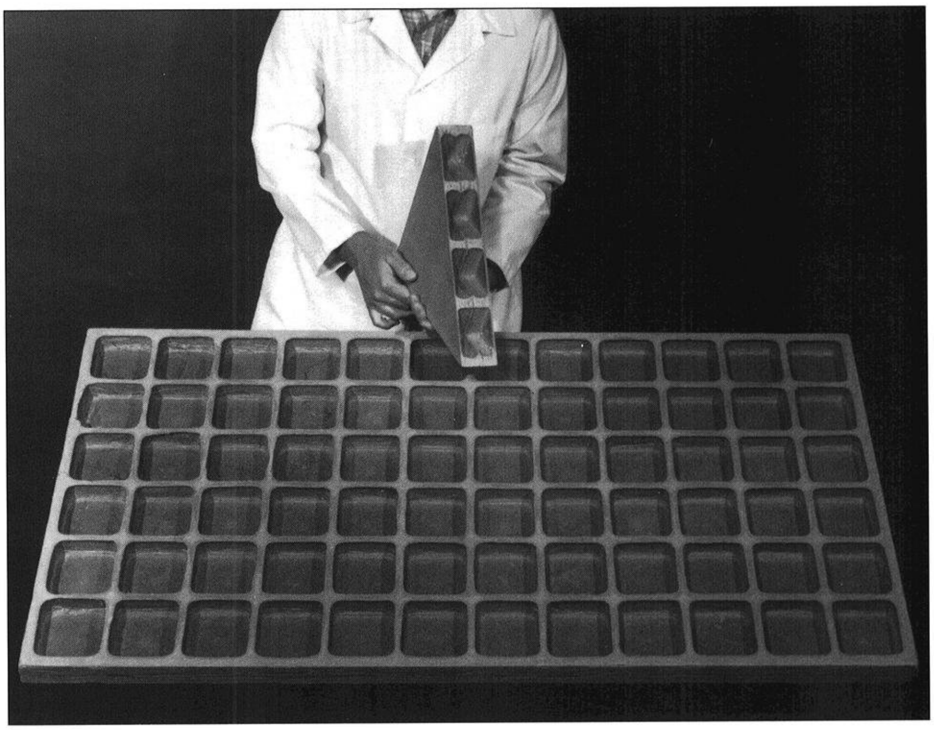
Wood and its relatives, agricultural fibers, are composed of polymers themselves. Cellulose, the fiber of paper, is based on a glucose monomer unit. The earliest commercial polymer was celluloid, made by nitrating cellulose and molding, but it had the unpleasant drawback of occasional explosion (cellulose nitrate is also called guncotton). Cellulose acetate is still used in packaging, and cellulose butyrate is used in screwdriver handles because of its outstanding shock resistance. Rayon was used as a clothing fiber and for industrial textiles, but the advent of cheaper petroleum derived polymers reduced use of all these naturally derived polymers.

One limitation to the use of cellulose as a polymer feedstock has been the need for heterogeneous reactions (reactions where one reactant is a solid and the others are liquid) and the insolubility of cellulose. The traditional process for rayon requires an extended pretreatment with carbon disulfide and solution in organic solvents as well as the need for a pure cellulose feed pulp (meaning additional cost). In recent years, new processes using lithium chloride to dissolve cellulose promise improved processes for cellulose modification. Lower cost rayon could be used to make low cost carbon fibers. The auto industry is poised to accept carbon fiber composites as a replacement for steel, but the cost is prohibitive (currently carbon fiber is $20 per pound). Current research in India, Bangladesh, England and Germany is testing the feasibility of natural fibers in composites. A major initiate in Germany is studying the use of flax in autobody panels. In India, substitution of jute fibers for glass in fiberglass composites produced composites with strength only an order of magnitude below that of glass, which is pretty amazing when you consider the glass fibers have been optimized with surface treatments for a resin system. Also, when you compare the cost of jute at $0.50 per pound to glass at $1.00 to $2.00 per pound, there seems to be plenty of room for natural fibers right now in materials with less demanding performance requirements. Future optimizations could make natural fibers a real competitor and an additional source of income for farmers.

As you continue your engineering career, consider natural materials as a substitute for nonrenewable resources. Wood and crop residues are everywhere and can yield surprising results for the engineer who carefully considers their weaknesses and exploits their strengths.

Author Bio: Jane O'Dell is a senior in Chemical Engineering and works at the Forest Products Laboratory. She owes a huge thanks to Karen, Sue, John and Dale for providing photos for this article.

Web sites of interest:
http://www.fpl.fs.fed.us/program.htm
http://www.fpl.fs.fed.us/pdcomp/
http://www.apawood.org/
http://www.ars.usda.gov



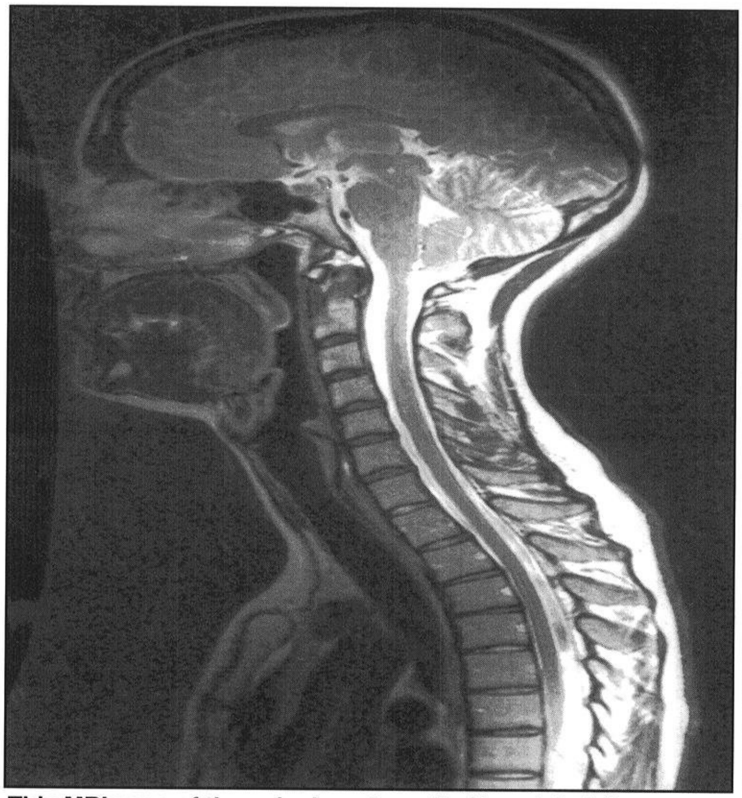
USDA-Forest Products Laboratory

Three-dimensional composite structural panel made by hot-pressing recycled paper fiber. The material has the strength to be used as wall and floor panels.

MRI: What's it all about?

You may not have had an MRI scan, but you probably know someone who has. When the doctor told you that you would need an MRI taken, you probably thought, "That's one of those pictures of your body, kind of like an X-ray or a CAT scan." Did you ever stop to wonder what it actually does and why it can take images of the internal parts of your body?

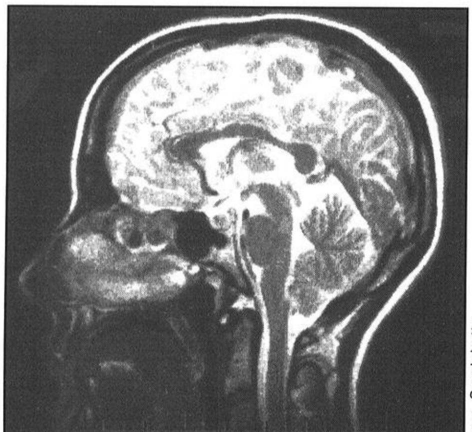
Magnetic resonance imaging (MRI) is the imaging of the body done through the use of magnetic fields and the absorption and emission of radio frequency waves. The images are taken without the help of an ingested agent, such as in CAT scans. They are also taken without the use of harmful ionizing radiation, like in x-rays. The process was originally called nuclear magnetic resonance imaging (NMRI) because of how it is used to obtain molecular information, but because of the negative connotation associated with the word 'nuclear,' it was dropped. Your body is made up of mostly fat and water. These two components of your body have many hydrogen atoms that compose 63% of the atoms in your body. Hydrogen protons possess the important property of spin that is used to aid in the imaging process. This spin is like a small magnetic vector that points in the direction of the magnetic field it is placed in. Therefore, when the body is in the magnetic field, the hydrogen spins line up with the field.



Source: Sarah Lotto

This MRI scan of the spinal cord can find herniated discs, tumors or cysts.

The magnetic field for an MRI is provided by a large, cylindrical magnet and is consequently the reason the MRI system is so large. The magnet makes up the tube part of the magnet that surrounds the inner 'bore.' where the body is moved in with the aid of an automated table. This magnet is made up of many superconducting wires that are coiled around the axis of the cylinder. The cylinders are kept at a temperature of about 4.20K (in order to hold their superconducting properties) with a layer of liquid helium surrounded by a layer of liquid Nitrogen at 77.40K. Gradient coils are used along with the magnet to provide a gradient in the magnetic field along its axis. This gradient provides the ability to image individual slices in the body by supplying a different location for each slice due to the difference in the magnetic field.



Source: Sarah Lotto

This MRI scan is of the brain. Images of the head can aid in the diagnosis of multiple scleriosis.

The other important component of the system that aids in the imaging is the Radio Frequency (RF) coil. There are actually a number of different shapes and sizes of RF coils used to image different parts of the body. The RF coils produce a second magnetic field that is pulsed onto the hydrogen atoms in the body and disturbs the proton spin. The spin vector not only points in the direction of the field, but it also rotates at an angle from the z-direction field axis due to x and y field components. This rotation happens at the resonant frequency of hydrogen. When the pulse of the second magnetic field occurs,

MRI's of the musculoskeletal system can help diagnose carpal tunnel in the wrist and cartilage tears in the shoulders or knees

the spin vector bends further away from the z-axis as it absorbs energy in the radio frequency range. After the pulse, the vector goes back to its resonant state by emitting the radio frequency wave. The RF coil detects the radio frequency wave emission and produces images based on spatial variations in the phase and frequency of the radio frequency energy being absorbed and emitted by the person.

The use of radio frequency waves produces the problem of keeping the system in a shielded room to prevent problems from outside radio waves and avoid in its own radio waves. The shielding room is also used to protect the outside world from the effects of the very powerful magnet. This magnet usually ranges from 1 to 1.5 Teslas, about the same amount used in a junk yard to pick up cars. Due to the power of this magnet, extensive screening is done to any individual before going into the scanning room. Any type of ferrous material will be attracted by the magnet. Many tools, keys, coins, jewelry or even steel-toed shoes are not allowed in the room as well as objects in the body such as pacemakers, metal fillings, pins, clips or shrapnel. In addition to endangering the patient, they can also damage the system. Imagine holding an average screw driver near the inside core, or bore, of the magnet. If let go, it will be traveling at 60 mph by the time it exits the tube. A simple 24 pound power supply will weigh 2000 pounds inside the bore of the magnet.

Smaller objects, such as zippers or jewelry, that may seem OK to handle in the room will inhibit radio frequency waves. This produces an artifact in the image or, in other words, a distorted the image. Another thing to keep in mind if working in such an environment, is not to step into the imaging room with credit cards or watches. Your credit cards will be erased and your watch will be permanently stopped by the magnet. Trust me, I now have a watch that does not work and I have had to send for a new credit card. The MRI can be used to diagnose many problems. Images of the head can aid in the diagnosis of multiple sclerosis and tumors while images of the spine can locate herniated discs, tumors or cysts in the spinal cord. MRI's of the musculoskeletal system can help diagnose carpal tunnel in the wrist and cartilage tears or ligament tears in the shoulders or knees. Some of the upcoming developments in MRI diagnosis are vascular imaging and breast imaging.

Magnetic resonance imaging is an important, high level technology used in hospitals all over the world. It affects many people's lives by aiding in quicker, more comfortable diagnosis of various problems. With this basic understanding of the MRI technology, you should feel more comfortable if you ever have to experience the procedure first-hand.

Author Bio: Sarah Lotto is a senior majoring in Electrical Engineering. She is also the 1999 Engineering Expo Co-chair.

Ronald E. McNair Postbaccalaureate Achievement Program

The Ronald E. McNair Postbaccalaureate Achievement Program is designed to provide information and enriching experiences, which will prepare undergraduate students to enter and excel in graduate school. Students who are considering study beyond the bachelor's level in either the biological or physical sciences (including engineering, business, psychology or mathematics) are encouraged to submit an application. Eligible students must meet the following criteria:

(1) First-generation college student (parent or guardian does not have a bachelor's degree) **and** from a low-income background as defined by the U.S. Department of Education, or a member of an under-represented group in graduate education, (2) junior or senior student with a GPA of 2.75 or higher, (3) student interested in pursuing a degree beyond the bachelor's level, (4) student who is a U.S. citizen or a permanent resident.

The McNair Scholars program provides the following activities/seminars:
(1) Graduate school application seminars covering graduate school selection, statement of purpose, obtaining financial support and improving GRE scores, (2) individual tutoring and academic advising, (3) assistance in selecting a faculty member to serve as research and career mentor, (4) funded research experiences, (5) support for participation in regional and national research symposia and conferences, (6) opportunity to participate in educational visits to various institutions nationwide, (7) potential to obtain financial assistance for graduate school application fees, (8) opportunity to present research findings at both regional and national conferences.

For further information, please contact Greg Markee, Program Coordinator (262-0631, gmarkee@mail.bascom.wisc.edu) or Laurie Mayberry, Program Director (mayberry@mail.bascom.wisc.edu).

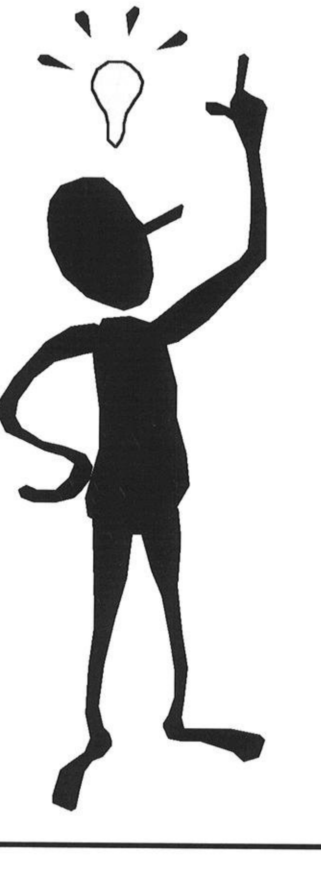
Thinker's Anonymous

It started out innocently enough. I began to think at parties now and then to loosen up. Inevitably though, one thought led to another, and soon I was more than just a social thinker.

I began to think alone - "to relax," I told myself - but I knew it wasn't true. Thinking became more and more important to me, and finally I was thinking all the time.

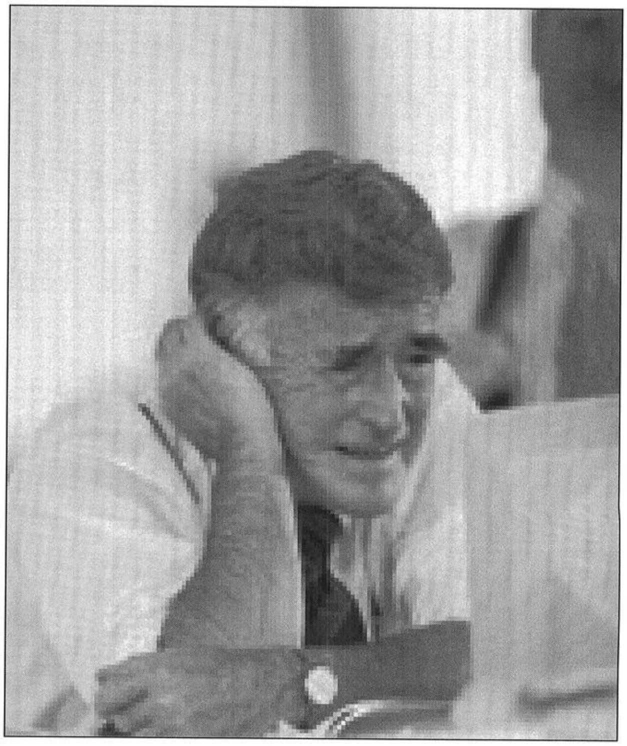
I began to think on the job. I knew that thinking and employment don't mix, but I couldn't stop myself.

I began to avoid friends at lunchtime so I could read Thoreau and Kafka. I would return to the office dizzied and confused, asking, "What is it exactly we are doing here?".



Things weren't going so great at home either. One evening I had turned off the TV and asked my wife about the meaning of life. She spent that night at her mother's.

I soon had a reputation as a heavy thinker. One day the boss called me in. He said, "Skippy, I like you, and it hurts me to say this, but your thinking has become a real problem. If you don't stop thinking on the job, you'll have to find another job." This gave me a lot to think about.



I came home early after my conversation with the boss. "Honey," I confessed, "I've been thinking..."

"I know you've been thinking," she said, "and I want a divorce!"

"But Honey, surely it's not that serious."

"It is serious," she said, lower lip aquiver. "You think as much as college professors, and college professors don't make any money, so if you keep on thinking we won't have any money!"

"That's a faulty syllogism," I said impatiently, and she began to cry. I'd had enough. "I'm going to the library," I snarled as I stomped out the door.

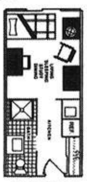
I headed for the library, in the mood for some Nietzsche, with a PBS station on the radio. I roared into the parking lot and ran up to the big glass doors... they didn't open. The library was closed.

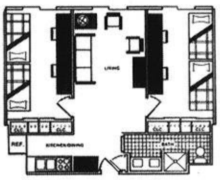
To this day, I believe that a Higher Power was looking out for me that night.

As I sank to the ground clawing at the unfeeling glass, whimpering for Zarathustra, a poster caught my eye. "Friend, is heavy thinking ruining your life?" it asked. You probably recognize that line. It comes from the standard Thinker's Anonymous poster.

Which is why I am what I am today: a recovering thinker. I never miss a TA meeting. At each meeting we watch a non-educational video; last week it was "Porky's." Then we share experiences about how we avoided thinking since the last meeting.

I still have my job, and things are a lot better at home. Life just seemed... easier, somehow, as soon as I stopped thinking.


Efficiency Apartment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