

The Ohio State  
**ENGINEER**

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Plus:  
Human Pesticides  
Frank Lloyd Wright  
The New Road Rage



**Engineering a Better Body:**  
Heart Transplants Go Artificial

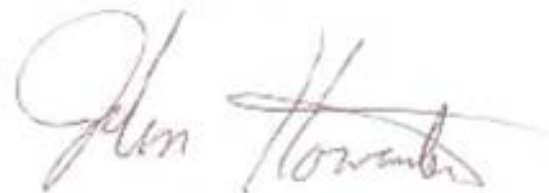
# FROM THE EDITOR

## A Delicate Balance

What is the value of a human life? Of course no dollar amount can be ascribed to such a precious asset. Likewise, ultimately all of our resources are in one way or another consumed in an effort to prolong and maintain life, whether it be that of an individual, or of a society. It makes sense; after all the goal of all living things is survival.

Thus, it should come as no surprise that the field of biomedical engineering is one of the newest specializations to arise. Let's face it, our bodies aren't built to last forever, at least not yet. And as different parts breakdown, it's only natural that they should be replaced. Is it practical to throw away a car merely needing a new transmission? Of course not; a replacement can be easily aquired. By the same token, an otherwise healthy person with a worn out heart, should ideally just get a replacement. Unfortunately that's not quite as easy as replacing a transmission. Previously a donor heart was necessary, either from another human, or sometimes an animal. Someday it may be possible to merely clone a replacement, but that comes with a sticky ethical situation, not to mention the technology is not quite there yet. An all around better solution may soon be available. An inorganic, mechanical heart has already been produced. Whether or not it will bring humans a step closer to our quest of immortality is yet to be determined.

The survival of the fittest is more than just a contest to determine who was born with the best body. All too often, lack of survival is due to outside forces. Whether it be something like a car accident, an environmental poison or the deliberate act of another person, it's a somber reality that life is contained in a delicate container. This being said, the preservation of life is a goal for more than just the medical community. Since Ralph Nader's book Unsafe at Any Speed was published, automakers have remained committed to consumer safety. Lately auto designers have focused on minimizing driver distractions, so other features like seatbelts don't have to be put to the test. We have our intellect and creativity to direct us on the quest for survival, and our human nature to get in the way.



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# TABLE OF CONTENTS

## features

**4**

Undergoing a Change of Heart  
Gabe Poling

**6**

The New Road Rage  
Mike Krantz

**8**

A Bit of Frank Lloyd Wright Down Home  
Stephanie Aurora Miller

**11**

Even More from Microsoft  
Arhan Gunel

**12**

Human Pesticides: Sarin and  
VX Nerve Gas  
Dan Huynh

## departments

**2**

From the Editor  
John Howarter

**14**

Scenes from the College of  
Engineering

**15**

Editorial  
Dan Huynh





# Undergoing a

**In an effort to increase the availability of hearts for transplant, the medical community looks to a mechanical answer to possibly replace current methods.**

BY GABE POLING

The number one cause of death in the United States is heart failure, taking the lives of more than 700,000 Americans each year. When a person's heart begins to fail there are not many options for repairing or replacing the ailing muscle. Though hundreds of thousands of transplants are needed, only about 2,000 people in the U.S. will be able to receive donor hearts this year. The high demand and short supply of available hearts have hastened the development of other, more mechanical transplantation solutions.

A large number of scientists and engineers have coordinated efforts to create a practical, mechanical substitute for the heart. At the head of the field, ABIOMED, Inc. has already successfully implanted two of its AbioCor Implantable Replacement Hearts in human patients in need of a transplant with a high degree of success. The AbioCor heart is intended for use with patients whose hearts have irreparably damaged ventricles, as well as suffer from congestive heart failure or coronary heart disease. Both Bob Tools, 59, of Franklin, Kentucky, and Tom Christerson, 70, of Central City, Kentucky, had similar serious heart ailments before receiving experimental AbioCor hearts at Jewish Hospital and University of Louisville Medical Center. Both pa-

# Change of Heart

tients have made considerable progress since receiving their respective new hearts, Tools on July 2<sup>nd</sup>, and Christerson on September 13<sup>th</sup>, 2001.

The AbioCor Implantable Replacement Heart is a fully implantable prosthetic heart given to patients with severely damaged hearts and imminent risk of death. The heart consists of two blood-pumping chambers simulating the ventricles of the heart, the right pumping blood to the lungs and the left to the rest of the body. Each motor-driven hydraulic pump can deliver over 2 gallons of blood per minute. An implantable electronics package monitors and controls the pumping speed and adjusts according to the body's needs. The package includes an active monitoring device providing detailed feedback and alarms in case of irregularities. An internal rechargeable lithium battery can power the heart up to 30 minutes, allowing the user to do such things as take a shower without the external battery connected. External power, serving to continually recharge the internal battery, is connected transcutaneously through the skin with the use of penetrating tubes or wires that increase the risk of infection. Weighing in at 2 pounds, the device is made of titanium and polyether-based polyurethane plastic designed to withstand the necessary 100,000 beats per



*Though not the first of its kind, this mechanical heart and others like it may soon make replacing the damaged organ more feasible than waiting for a donor.*

day. The smooth construction and design are engineered to reduce damage to blood cells and prevent clotting.

The results following the implantations of the first two AbioCor Replacement Hearts have been promising. Although the device is not the first of its kind, it is an important advancement in field of cardiac medicine. Though still in the early stages of its use, the artificial heart is achieving its goal of extending life and providing a decent quality to it. One thing is for certain, grabbing a heart off of the shelf is a lot easier than finding one to transplant.

*Gabe Poling is a junior in electrical engineering. He can be reached for comment at [poling.87@osu.edu](mailto:poling.87@osu.edu).*

# The New Road Rage

Are new car technologies steering the way to distraction?

by Mike Krantz

Do you own a cell phone?

For most readers, the answer is yes. In fact, it is common place to hear your own or someone else's cell phone ring accidentally during class or while driving down a busy street. Such are the vast wonders of technology. It is no wonder the automotive market is eager to invest in such a popular market. The result has been sophisticated car stereos and CD players, on board GPS guidance systems, and even DVD movie monitors, not to mention mounted cell phones. The world wide web is also slowly making its way to the car of the future. However, every time you look down to change the radio station or possibly queue the next song on your MP3 player, your attention is taken away from the road. For example, if you are driving 60 miles per hour, and take your eyes off the road for a mere two seconds,

you would have traveled 176 feet completely blind. That means, while putting in the newest Weezer CD, you could have crossed the entire width of the Olentangy River. So the question is, are the newest dashboard technologies the new age of automotive development, or are they simply driving us toward distraction?

To see a glimpse at the newest wave of automotive technology, sample the Cadillac Seville. With the purchase of this car, you are given the frivolous options of DVD based GPS, night vision, and in-car Cellular Phone jacks. These technologies eliminate the need for bothersome maps, allow the driver to see more clearly at night, and speak with both hands on the wheel. However, even though they enhance driver navigation, they also create new sources of stimulus that you must be aware of. For instance, if you are paying

# 92,000

The number of people in 1985 with cell phones.

# 77 million

The number of people in 1999 with cell phones.

# Brooklyn, Ohio

The first US city to ban cell phone use in vehicles. The law was enacted in 1999.

# \$3

The fine for first time offenders ticketed for driving and talking in Brooklyn.

# \$100

The fine for second time offenders or drivers involved in an accident.

more attention to reading the name of the street that you don't want to miss, you are less likely to be paying attention to the car barely three yards ahead of you. Luckily, the extensive map system and Cadillac OnStar on board assistance package will aid you in locating the nearest towing service after the car ahead of you stops short in front of you. However, Night Vision is a step in the right direction. Its purpose is for revealing more of the road to the driver during night situations. Unfortunately, depending on its location on the windshield, it could be as useful as a poorly placed mirror.

The real terror of distraction, how-

ever, lies in cell phone technology. On February 13<sup>th</sup>, 1997, the New England Journal of Medicine produced one of the most famous studies on cell phone usage and their effect on driving. The study predicted that individuals using a cell phone while driving increase the probability of getting in an accident by a little more than 400%. Thus the risks of being in an accident are similar to driving while slightly over the legal limit of blood alcohol. Furthermore, mounted hands-free cell phones produced the same results as their hand-held counterpart. Likewise, states such as New York, have banned the usage of cell phones while driving, and "Drive Now, Talk Later" initiatives have started. However, the study also proved the usefulness of cell phones after an accident. Those with cell phones received better response from emergency units.

In response to concerns about driving distraction, popular auto makers have provided information on the proper usage of dashboard technologies. Furthermore, Ford has produced a car simulator which is used to test different locations of dashboard accessories. However, as long as the features are away from the line of sight of the road, the potential of distraction is still high.

*Mike Krantz is a sophomore in mechanical engineering with a passion for cars. He is also a member of the Ford Living Learning Program. He can be reached for comment at [krantz.15@osu.edu](mailto:krantz.15@osu.edu). To learn more about the New England Journal of Medicine article go to [content.nejm.org](http://content.nejm.org). If you would like further information on driver distractions and a personal manifesto on the matter, see [cartalk.cars.com/About/Distraction...just don't do so while driving](http://cartalk.cars.com/About/Distraction...just%20don't%20do%20so%20while%20driving).*

# A Bit of Frank Lloyd Wright

## Down Home

by Stephanie Aurora Miller

“Go buy yourself a Jeep, then buy some land and build yourself a house, then build a house for your neighbors.”

A great rethinking of architecture occurred in the 20<sup>th</sup> Century. It was, as the Italian futurists described, a time to throw out tradition and analyze once again every aspect of architecture from the effects of materials to the social context of a new industrialized era. In America, Frank Lloyd Wright analyzed domestic architecture and then developed a theory called “organic architecture.” The boxy homes

were split up into pieces and rearranged on the landscape to provide for the greatest amount of view, air and sunshine for each room of the house. Not only was his design theory innovative, but more importantly so was his educational philosophy. As a college student, Wright studied civil engineering with a goal of eventually becoming an architect. Four months shy of graduation, he left school to train as an apprentice under the renowned American architect of that era, Louis Sullivan of Chicago. Trained as an engineer, and then apprenticed as an architect, Wright had the right combination of knowledge to revolutionize architecture in America and throughout the world.

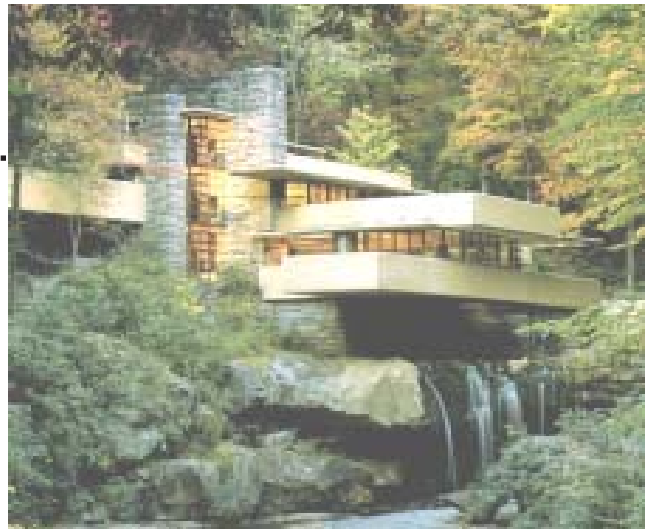
Later in his career, Wright planned and designed his ideal vision of an architecture school. His vision was to train young architects in much the same way he had been trained, as apprentices who worked under well-respected architects. His school was, and still is today, set up between two sites, Spring Green, Wisconsin, called Taliesin East and Scottsdale, Arizona called Taliesin West. He and the students would travel between

the two sites, gaining practical experience in the engineering, construction, materials and aesthetics of organic architecture.

“Go buy yourself a Jeep, then buy some land and build yourself a house, then build a house for your neighbors.” This was the advice that Frank Lloyd Wright gave to his apprentices of the 1950’s toward the end of his career. One of his apprentices, Martha Wakefield of Worthington, said that she was one of the few who heeded his advice. She has since become quite famous for Wright’s vision.

A housing settlement, called *Rush Creek* was founded in a rural area just outside the heart of Columbus in Worthington. Now located in a crowded residential area, there remains a sentiment of recluse surrounded by the natural landscape.

Martha joined Wright’s school in the early 1950’s. Though she was excellently trained and more knowledgeable than many peers in her field, she lacked the nationally recognized diploma from an accredited architecture school. Moreover, she had to battle the unfortunate prejudices that surrounded her position as a woman architect in a



*Falling Water: architecture blended with nature*

### **Frank Lloyd Wright: A Closer Look**

The ability for an architect to have detailed knowledge about the engineering, construction and materials of the building gives the architect unprecedented power. Furthermore, this type of knowledge allows an architect a greater freedom for experimentation. Given that Frank Lloyd Wright engineered his own buildings, he was able to design Falling Water, the most notable home built in the United States. Contemporary engineers reportedly said that the cantilevers of Falling Water would most definitely fail. These cantilevers reached out from the core of the building into the beautiful Pennsylvania landscape and were much appraised by the Kaufmans. “No, I know that architecture is life; or at least it is life itself taking form and therefore it is the truest record of life as it was lived in the world yesterday, as it is lived today or ever will be lived,” said Wright of organic architecture. According to Wright, he believed one of the most beautiful aspects of life is to live on and in the landscape much in the same way as the Native Americans. His architecture continually grafted itself into the shapes and nature of the surrounding landscape. The cantilevers that stretch into the natural surroundings provide for Wright the fulfillment of this following description he gave, “So the life of the individual was broadened and enriched by the new concept of architecture, by light and freedom of space.”

man's field. The lack of a degree from an accredited school prohibited her from having full authorship of the plans for the homes. By law, she needed a registered architect to stamp and sign the drawings. Moreover, she needed a construction manager and builder who later became her husband, Richard Wakefield. As a team, they built a business out of their home.



*A non-traditional home both in appearance and reality, Martha Wakefield is able to live in a seemingly rural setting in crowded Worthington.*

Though not working solo, Martha was both the visionary of Rush Creek and undoubtedly the brain behind the fifty homes in Rush Creek.

Indoctrinated by Wright's architecture, Martha's view of housing had forever changed. She complained about the white-walled, boxy traditional home as "claustrophobic." Her main objective, like that of master Wright, was to build an economical, 1000 sq. ft. home that breathed into the natural landscape with an air of spaciousness. Eventually, the interior with the exterior, the living space

with nature all morphed together. The natural tones of the interior decoration and the rustic, exposed materials further enhanced the morphosis of home and landscape. Her tools were a mastery of the science of geometry and most importantly the power of knowledge.

On a tour through her house, she described in detail the construction methods, engineering feats, the specifications of materials utilized as well as the logic behind the design and how it gives the illusion of freedom. Most people who tour her home are anxious to live in one of her designs. Not one of the fifty homes have yet been placed back on the housing market. Thus, Martha has a 50-person waiting list of those who hope for a chance to own one of her occupied homes.

Martha Wakefield is worthy of imitation. She is a remnant of Frank Lloyd Wright and an example of a woman who was not satisfied nor limited by social boundaries. Furthermore, she is an example of why we should be as knowledgeable as possible in our profession. Not all architecture need be organic, but until we fully understand why so many people are highly satisfied in her economical and beautiful homes, we do not yet have the legitimate ability to disqualify her efforts as unsuccessful.

*Stephanie Aurora Miller is a typical graduate of Sarah Lawrence College in Bronxville, New York. She will graduate with a Masters of Architecture Studies in the Spring of 2002. If you would like a free tour of the Wakefield home please contact The Ohio State Engineer at [ose@osu.edu](mailto:ose@osu.edu).*

**Photo credit - Olivia Miller**

# Even More from Microsoft

by Arhan Gunel

## **Windows XP (is somehow an acronym for Windows eXPerienced??)**

Windows XP, Microsoft's state-of-the-art consumer PC operating system, is a juggernaut of both programming ingenuity and commercial domination. Released in late October, Windows XP is being touted as the most stable consumer version of Windows to date, a plus especially for large companies since down time equals lost money, seamlessly integrated with a host of graphically admirable, user-friendly features. PC critics were admittedly impressed with Microsoft's effort, but of course they had reservations. Many complain that the OS, taking up over 2 gigabytes of hard drive space and requiring at least 128 megabytes of RAM, was built for very new and speedy computers and that unwary users, after spending over \$100 for their new software, would be disappointed with the operating system's miserable performance on their older machines. Computer manufacturers, on the other hand, hope that the demand for speed hungry Windows XP will spawn a new wave of PC buyers that will rejuvenate the slumping PC industry.

## **Something Microsoft Doesn't Dominate?**

Is it possible that Microsoft doesn't have total monopoly power? Heresy! When it comes to the world of video games, Microsoft is a rookie. No longer able to use the massive commercial muscle that it exercises in the PC world, Microsoft's attempt at a video game console, the Xbox, enters the ring against Japanese powerhouse Sony and the venerable creator of modern video games, Nintendo. Built with a custom-made Intel Pentium III, the Xbox claims technical superiority over both the current market leader, Sony's PlayStation 2, as well as Nintendo's GameCube. However, as observed in recent years, having a better machine does not win a console war. The Nintendo64 was declared a much more powerful machine than Sony's original Playstation. But because of clever marketing as well as luring high quality software developers, the Playstation was able to overcome its technical deficiency. With the Playstation 2 already on solid ground for over a year and Nintendo's age-old ingenuity and brand name, will Microsoft be able to make the Xbox into a viable gaming platform? When encountering problems, Microsoft's usual solution is to turn competitors into assets by buying them out. This time around, however, the market is already controlled by corporate behemoths. Microsoft is finally picking a fight with someone its own size.

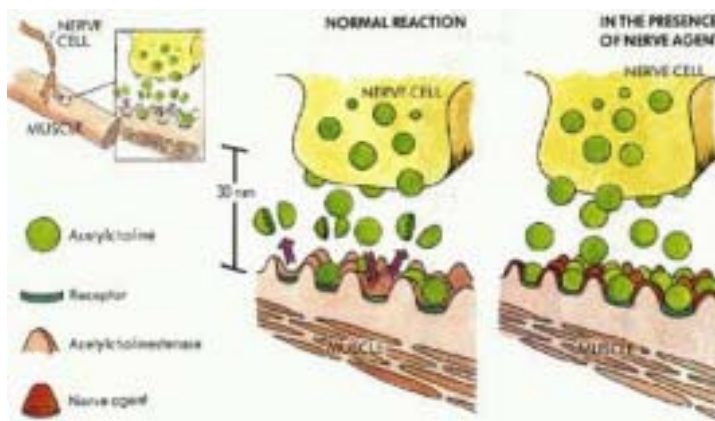
*Arhan Gunel is a junior electrical engineering major. Much of his free time is devoted to strenuously researching video games. He can be reached for comment at [gunel.1@osu.edu](mailto:gunel.1@osu.edu)*

# Human Pesticides: Sarin and VX Nerve Gases

by Dan Huynh

The beautiful day envelops you. Not a cloud in the sky, you are immersed in the nation's favorite pastime with your friends on this picturesque midsummer afternoon at the ballpark. Suddenly, breathing becomes strenuous and difficult as your chest tightens. Watching your friend's pupils constrict to tiny circular points, the word, "help" slurs off your over-salivating tongue. Wiping the perspiration from your pulsating brow and your runny nose, the view of your drooling friend morphs into a blurry haze as confusion spirals in. The hollow sound of vomit hitting the hard, plastic seats echoes through your ears as you begin to twitch and convulse uncontrollably. Falling in and out of consciousness, you smell the foulness of urine and bile that has uncontrollably exuded from the patrons beside you. Death is eminent, for you have become a victim of nerve gas.

In the wake of the unforgettable terrorist strike against the United States on the haunting date of September 11, 2001, an innocent nation was forced into a fear that has not been confronted since the infamous day at Pearl Harbor in 1941. We were attacked—blatantly, forcibly, and heinously. Following cathartic air assaults on Osama bin Laden's terrorist network in the middle-eastern country of Afghanistan, several cases of the deadly bacteria *anthrax* were reported across the United soil—Florida, New York, and even our nation's capital, Washington, D.C. However, no widespread epidemic has broken out, and fatalities are at a minimum. Nevertheless, more biological and chemical weapons of mass destruction circulate around the globe today. Two of these apocalyptic agents are *sarin* and *vx*, two of several nerve gases.



Biochemical mechanism of nerve gas.

## Sarin-dipity

Developed by the Nazis in 1938, *sarin* was produced not as an instrument of war, but as an effective pesticide. Reminiscent of its predecessor, *vx* or *o-ethyl s-diisopropylaminomethyl methylphosphonothiolate* was originally developed as an alternative pesticide to DDT in 1952 in England. Similar to other nerve gases, *vx* and *sarin* are *cholinesterase* inhibitors, vehicles that block the impulse transmission in the central nervous system. The chemical *acetylcholine* allows the electric signal from the brain, through a nerve, to cross the synapse—gap between the nerve and muscle—allowing movement control of the body. In order to force the nerve back into a passive state, *acetylcholine* normally is divided by *cholinesterase*. However, being a *cholinesterase* inhibitor, *vx* and *sarin* force the nerve to prolong its active state causing the muscles to continually trigger, forcing the muscles to spasm uncontrollably.

Though similar in the chemical reaction respect, *sarin* vaporizes more easily, and can be spread through the air at a more proficient rate. Although *sarin* can easily cover a wider area quicker, *vx*, drop for drop, is more potent and deadly.

## The Heart of the Matter

Quickly putting its victim on the brink of an excruciating death, *vx* and *sarin* exposure must be treated immediately. Using a spring-loaded autoinjector, the antidote of *atropine* is the best way to combat this inhumane chemical agent by administering it in a large muscle, such as the thigh. In the movie, *The Rock*, the protagonist stabs himself in the heart with an *atropine*-filled needle when exposed to *vx*. Although the heart is an effective target for *atropine*, the realism of this highly intense and dramatic scene is extremely minute. Protected heavily by the rib cage, the heart is very difficult to puncture properly and accurately, especially given the high stress circumstance involved. Although being a nerve gas itself, *atropine* remains the best treatment for *vx* or *sarin* exposure. By targeting muscarinic receptors in the muscles, *atropine* blocks *acetylcholine* from binding with these receptors, thus halting nerve impulses. Within fifteen minutes after an injection of *atropine*, a rapid heart beat and dry mouth should occur, therefore giving the first signs of recovery and *atropinization*.

## Saddam's Sadism

According to the Federation of American Scientists, Iraq utilized nerve gases against Iran during the mid-1980s conflict between the two nations. Deploying missiles laced with *tabun*, a simplistic nerve gas, Iraq became the first country to use nerve gas as a weapon of mass destruction upon a warring foe. Iraqi research and development of nerve gases soon began to escalate, climaxing with the development of *sarin* and *vx*. The apex of Iraq's evil, horrific practices dawned in 1988 when Saddam Hussein's henchmen dumped *tabun*, *sarin*, and *vx*-tainted bombs on civilian Iraqi Kurds who sympathized with their Iranian neighbors.

Furthermore, according to United Nations inspectors, *sarin*, *vx*, and other chemical warfare devices were destroyed upon UN-sanctioned inspections. Some scientists believe that the so-called "Gulf War Syndrome" diagnosed in many

United States military personnel is a result of exposure to *sarin*, *vx*, and other nerve-affecting compounds. However, no concrete evidence has been discovered to support and affirm this theory.

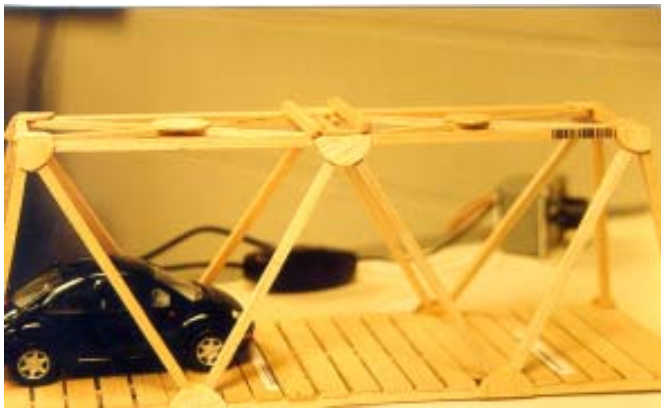
## The End of the Innocence

Signs and warnings of the availability of harmful nerve gases stem as far back as the era of the Reagan administration. The world's superpowers of the United States, England, Germany, and France are not the only peoples that possess the technology and will to produce deadly bio-hazardous agents. Using the dreadful nerve toxins in war has been ethically debated for almost a century, leading back to Nazi Germany, the developers of the first nerve toxins. Even the rogue that murdered and slaughtered millions of Jews restrained from the use of these devilish weapons against their enemies. Notified that the Allies possess aerial superiority and that German nerve gases could be the one element to turn the tide and win the war, Adolf Hitler still disallowed the deployment of these doomsday devices.

The 1980s were not only marked by bubble gum pop music, big hair, and supply-side economics, but also the disappearance of the thin line that separated the ethical rules of war from unjust actions. A sanctuary for terrorism, Iraq should have awoken the innocent, naïve world to the serious threat of bio-terrorism and bio-warfare. Presently, with the United States' War on Terrorism on the horizon and the threats of *anthrax* spreading across the country, it is essential for the world to understand that boundaries or rules for wars cease to exist. Terrorism has awakened the napping world, ending the innocence, and hopefully the world will stay awake and be prepared.

*Dan Huynh is a junior in electrical engineering. He is a former participant of the FEH program, and represents IBM as their Campus Ambassador. He can be reached for comment at [huyh.34@osu.edu](mailto:huyh.34@osu.edu).*

# SCENES FROM THE COLLEGE OF ENGINEERING



*A variety of wood bridges made by freshmen in the Introduction to Engineering 180-181 series display creativity, school spirit, and possibly the application of some engineering principles. These bridges were constructed to be destroyed, as they were tested to determine the maximum load supported before breaking.*

**Photo credit - Miranda Marcus**

# The American Spirit

A symbol of economic power—gone. A symbol of military power—gone. Many innocent people of all religions, races, and cultures—gone. In a city known for diversity and a country known for freedom, liberty, and justice, horror and sorrow have stricken its children. Played over and over again, on television and radio channels all across the world, I still cannot fathom what my eyes reveal to me. Each time I watch United Airlines flight 175 accelerate and spear through, spearing through the south tower of the World Trade Center, I have to tighten the muscles in my face to hold back the tears that I know will inevitably trickle down; not because I personally know the victims in the planes or in the buildings, but because of the heinous crime enacted upon my innocent brothers and sisters. In the streets halfway across the globe I see people cheer in celebration of this unwarranted massacre. What could make someone execute such horrific and brutal acts? I cannot explain it, but for whatever reason, may it be religious, political, or social, nothing can justify the sadistic acts that occurred on September 11, 2001.

Doers of evil, these terrorists have tried

to take away our economic confidence and our military confidence. However, they have overlooked the essential and most important traits of American society—freedom, liberty, and justice—the American Spirit. There, in the somber, wallowing waters of New York Harbor still stands tall and proud, Lady Liberty. Smoke and fire laying in the backdrop, encompassing the weakened New York skyline, She faces the world. There, She stands tall and proud of Her people with Her ever-burning light of freedom



Stuart Ramson - AP

and liberty in one hand, and a tablet of Her birth date hoisted in the other. The terrorists forgot that Her country was created on the basis of freedom and liberty. What a thing to overlook, for justice will come soon and swiftly. Her seven rays atop Her crown represent the seven continents of the world, the lands She will bring together. She has helped Her friends in times of need when disaster has struck, and these friends will come to cleanse and heal Her wounds, nurturing Her back to strength and giving Her the power to avenge Her grief-stricken children. As philosopher Friedrich Nietzsche once wrote, "What does not destroy me, makes me stronger." A message: Lady Liberty is not dead.



# PROGRESS

