

Spring 2006

Nebraska Blueprint – Spring 2006

Follow this and additional works at: <https://digitalcommons.unl.edu/engineeringblueprint>



Part of the [Engineering Commons](#)

"Nebraska Blueprint – Spring 2006" (2006). *Nebraska Blueprint (Student Publication)*. 19.
<https://digitalcommons.unl.edu/engineeringblueprint/19>

This Article is brought to you for free and open access by the Engineering, College of at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Nebraska Blueprint (Student Publication) by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

Medical Marvels

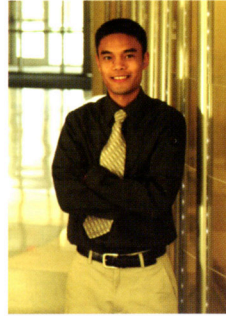
Inside Biomedical Engineering



2005-06 Nebraska Blueprint Staff



Martin Gakuria
Sophomore, BSE
Online editor



Brian Hernandez
Sophomore,
News-Editorial



Chris Kohler
Senior, MECH
Advertising manager



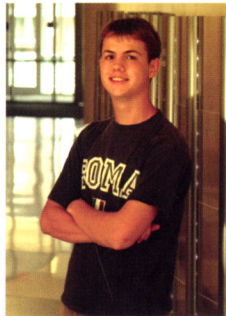
Michaela McBride
Freshman, BSE
Writer



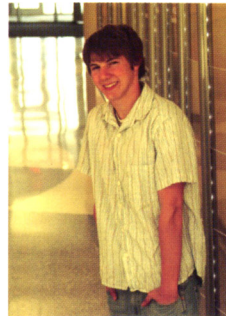
Cecelia Orwig
Sophomore, English
Assistant editor



Frank Pribyl
Senior, MECH
Editor



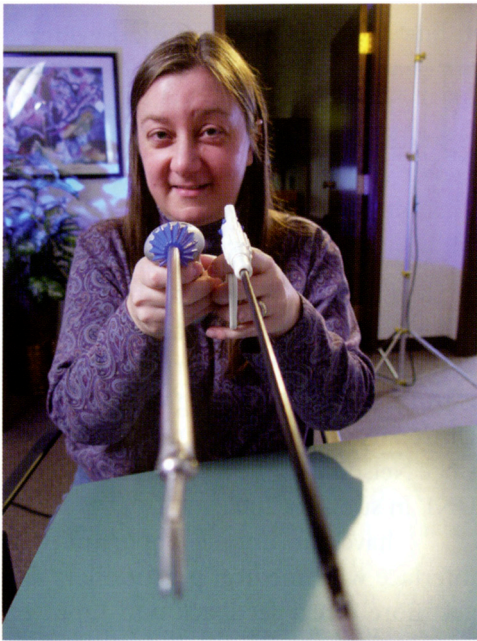
Joel Schulte
Freshman, MECH



Brian Watt
Freshman, BSE
Cover Design

Join the Nebraska Blueprint Staff

The Nebraska Blueprint staff is looking for writers, editors, photographers and designers for the 2006-07 school year. Students of any major may apply. The Blueprint staff will meet twice a month (day and time to be announced at a later date). For more information, e-mail Editor Frank Pribyl at unlfrank@gmail.com or contact Adviser Ashley Washburn at 472-0451 or awashburn2@unl.edu.



See Medical Marvels, Page 4



See Medication Nation, Page 8



See The Freshman Connection, Page 10

Table of Contents

4 Medical Marvels, by Michaela McBride

8 Medication Nation, by Martin Gakuria

10 The Freshman Connection, by Cecelia Orwig

12 E-Week Wrap-up

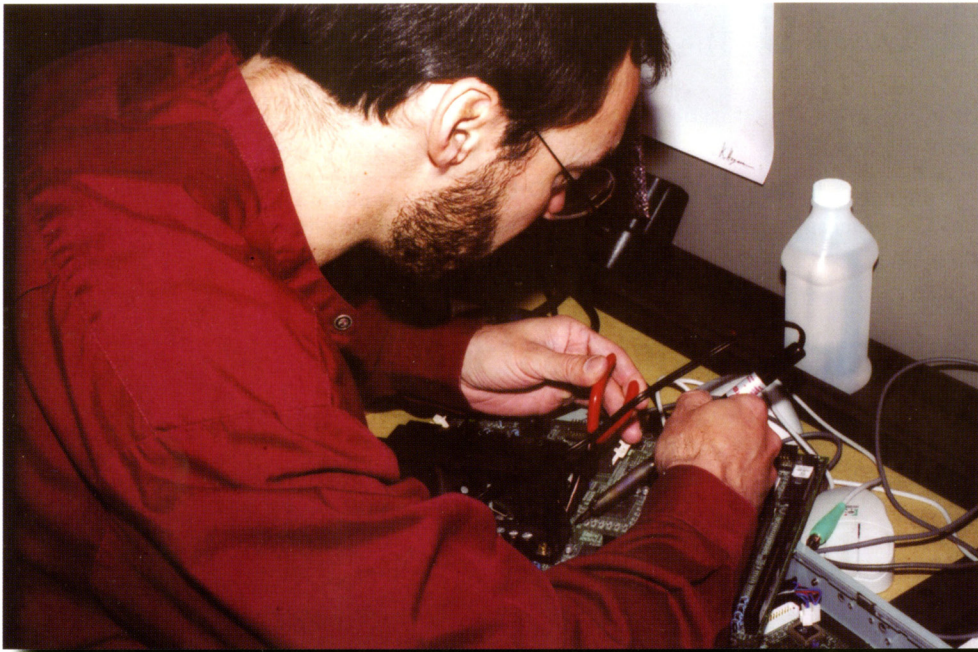
UNIVERSITY OF
Nebraska
Lincoln

The Nebraska Blueprint is produced by students of the University of Nebraska–Lincoln College of Engineering and is published twice a year. Reprint requests in the form of articles, photography or original artwork should be addressed to Nebraska Blueprint, 203 Othmer Hall, P.O. Box 880642, Lincoln, NE 68588-0642; telephone (402) 472-0451; fax (402) 472-7792. The University of Nebraska–Lincoln does not discriminate based on gender, age, disability, race, color, religion, marital status, veteran's status, national or ethnic origin, or sexual orientation.

Medical Marvels

By Michaela McBride

When it comes to biomedical engineering research, the University of Nebraska–Lincoln is pioneering new ideas through the number and variety of research projects underway. Biomedical engineering ties many branches of engineering together, encouraging teamwork and collaboration among departments as well as outside partners. This is a snapshot of some of the ongoing biomedical research at UNL.



Steve Goddard, associate professor of computer science & engineering

Robot-Assisted Surgery and Surgical Tool Design

Carl Nelson, an assistant professor in the Department of Mechanical Engineering at UNL as well as in the Department of Surgery at UNMC, is currently doing research in robotics, mechanical design and optimal design. He became interested in the biomedical engineering field after observing the increasing need for engineering in medicine as technology becomes more advanced. “I felt this was a good way to apply my background in mechanical engineering and have a positive impact on society,” he said.

“My research projects are in robot-assisted surgery, surgical tool design and other biomedical applications,” Nelson said. These ideas were born while he was getting his doctoral degree at Purdue University and have grown and expanded since Nelson became a faculty member at UNL in summer 2005.

“I have the unique opportunity to interface with medical practitioners and get more direct feedback and input on how engineers can contribute to meeting their needs,” Nelson said. “This is a very valuable link and will help increase my effectiveness in delivering technologies that will positively impact the patients.”

Biomedical Imaging and Signal Analysis

Greg Bashford is a biomedical engineer and an assistant professor in the Department of Biological Systems Engineering. His research focuses on biomedical imaging and signal analysis. “Our lab is working on measuring true three-dimensional volume blood flow using ultrasound, improving contrast and resolution in ultrasound for breast cancer screening, and visualizing cracks in teeth for dental applications,” he said. “We also have a collaboration with Madonna Rehabilitation Hospital for analyzing signals from wearable body sensors and analyzing ultrasound images for tendon and ligament structure.”

The projects involving breast cancer screenings and blood flow were inspired by Bashford’s time working in industry before coming to UNL; the other projects are based on the collaboration with doctors from UNMC and Madonna. All these research projects have a common goal—to make a difference in health care practices. “In biomedical engineering, you have a chance to make a real impact on people’s lives,” Bashford said.

Bashford emphasized the importance of teamwork in biomedical engineering, and particularly in research. “Biomedical

engineering is a very broad field, and in a big project no one person has all the expertise needed. For example, in the tendon project, we have a collaborator from Madonna in biokinesiology, myself in engineering, plus several students helping out.” The students involved are seniors in the Department of Biological Systems Engineering.

Robots for microscopic surgery

In 2003, UNMC and UNL held a meeting to spark new ideas for research. It was through the discussion at this meeting that Shane Farritor, an associate professor of mechanical engineering, decided on his next research project: bioengineering robots for microscopic surgery. “These cylinder-shaped mini-robots are only about 70mm long and 15mm wide. They are inserted into the body during surgery to give surgeons visual feedback, among other things,” Farritor said.

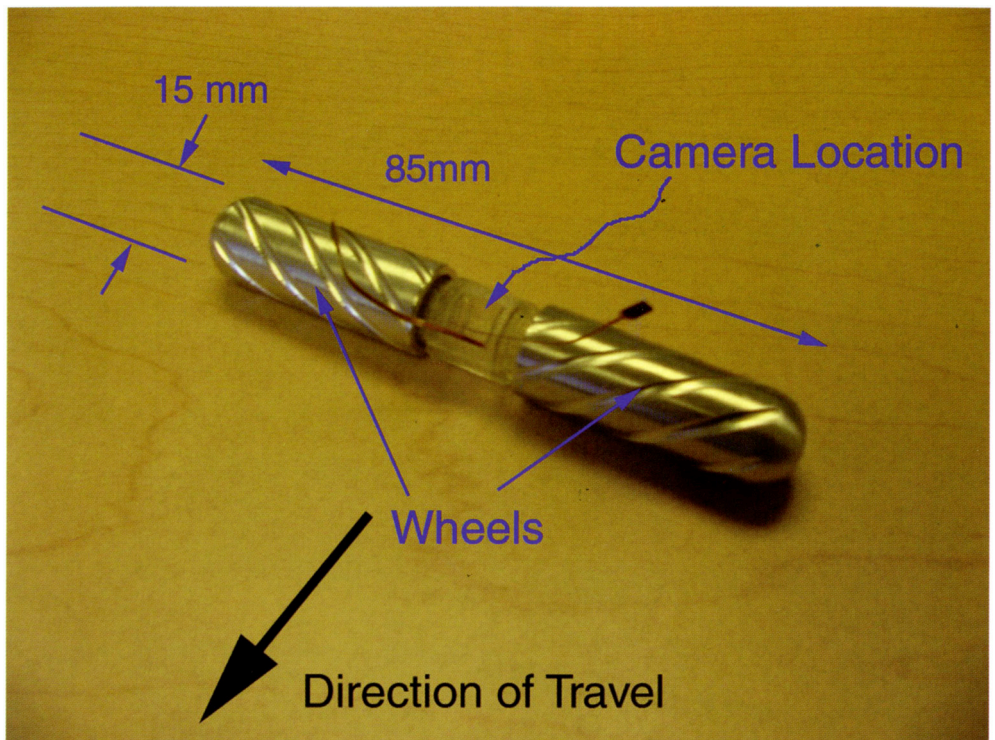
The robots are still in the prototype stage; they are currently being tested in animal surgeries and could be used in human surgeries for research fairly soon. Farritor and the graduate students helping with the project are involved throughout the entire research process, including observing the surgeries the robots are used for at UNMC. Farritor said it will be a few years before they are used commercially in human surgeries.

Bioinformatics

Khalid Sayood from the Department of Electrical Engineering is doing research in collaboration with researchers at UNMC in the areas of data compression and bioinformatics, which involve how information is organized in data. Data compression involves samples of speech, pixels in an image or video and characters of text; while bioinformatics involves data in the forms of DNA sequences of the genomes and the amino acid sequence of proteins. “Our work will help in areas like epidemiology and in developing strategies for combating microbacterial infections,” Sayood said.

The partnership between Sayood and the researchers at UNMC improves the efficiency and increases the success of the project. “I rely on the researchers’

knowledge of medical and biological things, and they rely on me for knowledge of algorithmic things,” Sayood said.



Mechanical engineering associate professor Shane Farritor’s surgical robot

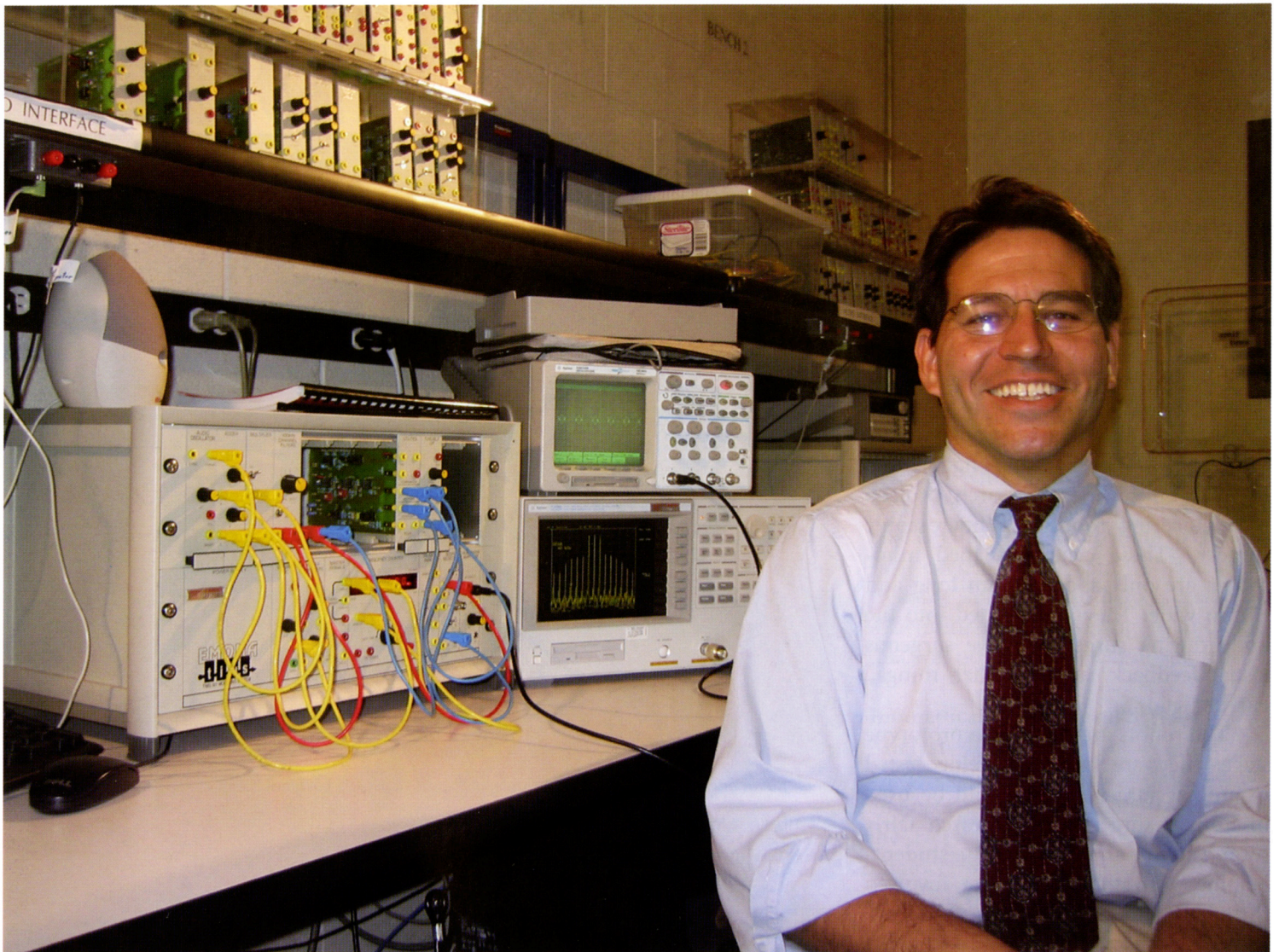
Wireless Communication to Increase Independence

Lance Perez is also in the Department of Electrical Engineering and doing research in the biomedical field. The heart of his research deals with wireless communication and applying it to help people who are elderly or disabled live independently as long as possible. “This is all about allowing people to stay out of nursing homes and be on their own longer,” Perez said.

Perez and Stephen Goddard of the Department of Computer Science & Engineering, working in collaboration with Madonna and several graduate students, have developed a “smart room” that is equipped with wireless sensors that communicate with a tag the person wears. This research enables the person to control the environment, such as lights, temperature and the shades, as well as giving prompts for patients with short term memory loss and detecting if the person has warning signs for a heart attack, stroke, or if they have fallen. This information could be available to family members and caregivers over the

“Our work will help in areas like epidemiology and in developing strategies for combating microbacterial infections.”

-Khalid Sayood



Continued From Page 5

Internet to allow the individual more independence. Perez summed up the goal of the project, saying, "Good engineering should help people."

The focus of the engineering behind all these applications deals with the wireless communication between the sensors found in the room. "Our goal is that you should be able to throw the sensors into a room and they could communicate effectively," Perez explained.

This idea for this research was born when Perez was working with Madonna. "Seeing the problems they had getting patients home was difficult; I wanted to help make people more independent," he said.

PCR Technology

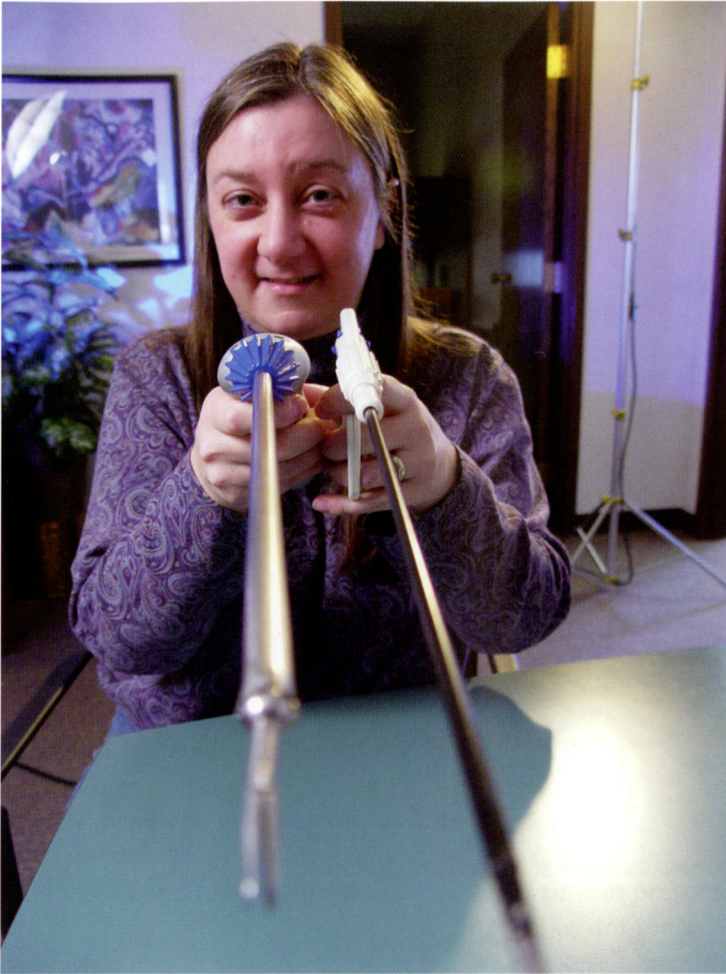
George Gogos, professor of mechanical engineering, and Hendrik

Viljoen, professor of chemical and biomolecular engineering, are working together on increasing the speed of Polymerase Chain Reaction (PCR) technology. PCR is a technique in which strands of DNA are replicated over and over until they can be identified for diagnostic purposes. "This project is interdisciplinary," Gogos said. "A team of biochemists, chemical engineers and mechanical engineers each add expertise to make this project a success." They have partnered with Megabase Research Products, a local biotechnology firm.

Currently, PCR technology is being used in the industry, but it takes two to three hours to replicate enough DNA to diagnose the sample. Gogos and Viljoen and their team of undergraduate and graduate students have developed the Vortex Tube—an instrument that accelerates the replication of DNA, which in turn greatly reduces the time it takes

"Seeing the problems they had getting patients home was difficult; I wanted to help make people more independent."

-Lance Perez



Opposite page: Lance Perez, associate professor of electrical engineering, in his lab. Left: Susan Hallbeck, associate professor of industrial & management systems engineering, holds the IntuiTool, an ergonomically correct surgical tool she designed. Below: Mechanical engineering professor George Gogos. Photos courtesy of the College of Engineering and UNL Publications and Photography.



to identify the DNA sample. Gogos said this new technology would be useful in the vast number of fields that use DNA-based tests such as hematology, virology, medical diagnostics, forensics and biological warfare agent detection.

One of the main goals of this research is to make the equipment mobile. “We want the Army to be able to have the equipment on the field to test for biological warfare; it can communicate wirelessly with computers so they will have immediate access to the results instead of waiting for several hours,” Gogos said. They have successfully tested the technology on a truck in a field.

Gogos described another application of this technology: organ transplants. The tests on donated organs that are required before implantation could be done in minutes instead of hours, decreasing storage time and hopefully increasing the success of the transplants.

Laparoscopic Surgical Tools

Susan Hallbeck is a professor of industrial & management systems engineering, has a courtesy appointment in the Department of Surgery at UNMC and is both a certified professional ergonomist and a professional engineer. Her research focuses on ergonomically designing laparoscopic surgical tools to make surgery less invasive. “I hope that surgeons have an easier time using their tools, and therefore have a longer career as they may not have as many injuries,” she said.

Hallbeck said she first became interested in the biomedical field when she was working as an explorer scout in the Mayo Medical Explorers in Rochester, Minn. “This showed me that biomedical research didn’t mean you had to have an M.D. degree,” she said.

“We want the Army to be able to have the equipment on the field to test for biological warfare so they will have immediate access to the results instead of waiting for several hours.”

-George Gogos



Medication Nation

Pharmaceutical industry grows as it finds new uses for common drugs

By Martin Gakuria

U.S. Department of Health and Human Services statistics show that almost half of Americans take prescription drugs. Half of the elderly population takes three or more prescription drugs. This makes America the most medicated nation on earth. This has led to an increase in life expectancy to 77.3 years and has also helped reduce the nation's three health-related killers—cancer, heart disease and stroke. In turn, this trend has led to the ever-expanding pharmaceutical industry that reports close to \$1.6 trillion in sales annually.

According to medical consumer reports, these are the top 10 most common drugs used today.

Botox

Purpose: Typical neuromuscular modulator

Studies have suggested that Botox is effective in relieving migraine headaches, excessive sweating and muscle spasms in the neck and eyes. It is also a popular plastic surgery product because the drug temporarily reduces frown lines and creases in the skin. It is approved by the Food & Drug Administration for the treatment of at least 20 neurological and therapeutic disorders.

Insulin

Purpose: Typical hormone

The pancreas naturally produces insulin in the body. Insulin has been

a standard diabetes treatment for 80 years. The initial source of insulin for diabetic treatments was derived from the pancreas of cows, pigs and fish. Today insulin is manufactured through genetic engineering techniques.

Cisplatin

Purpose: Typical anticancer

Cisplatin is a platinum-based chemotherapy drug. It slows the growth of cancer cells and is used to treat testicular, ovarian, bladder, lung and stomach cancers.

Viagra

Purpose: Typical vasodilator

Derived from sildenafil citrate,

Viagra was introduced as a chest pain reliever for men. It was further developed to treat pulmonary arterial hypertension. However, it is perhaps best known for its ability to treat erectile dysfunction. Viagra's annual sales from 1999 to 2001 exceeded \$1 billion.

Fentanyl

Purpose: Anesthetic

Ever had surgery? Your doctor might have used fentanyl to keep you comfortable afterward. With an analgesic potency 30 to 100 times higher than morphine, fentanyl citrate is widely used in chronic pain management. Fentanyl is classified as a narcotic, and illicit use of this drug has risen in recent years because of its wide availability.



Quinine

Purpose: Typical anti-malarial

Quinine has antipyretic, analgesic properties and is used to treat 300 million to 500 million cases of malaria annually. It starves the malaria parasite, plasmodium, and renders it unable to break down hemoglobin. Quinine is also used in the food industry to produce tonic water and food additives.

Thorazine

Purpose: Typical antipsychotic

One of the first drugs available to treat schizophrenia, thorazine acts as a blocking agent on brain receptors. The property of the drug makes it a useful muscle relaxant for cats and dogs. The drug also has been used to treat cholera because it significantly reduces the loss of water in the body.

Isoniazid

Purpose: Typical antibacterial

Isoniazid is used to treat tuberculosis. Due to its effectiveness and mild side effects, it has been used to treat TB in HIV/AIDS patients. Isoniazid has been popular since the 1950s because it is inexpensive to produce and readily available in tablet, liquid and injectable forms.

Aspirin

Purpose: Typical analgesic

With a chemical formula of 2-(Acetyloxy), benzoic acid aspirin is often used as an analgesic against minor pains and aches. It's also a successful anticoagulant (blood thinner) and may be used in low doses over long periods of time to prevent heart attacks. Aspirin's major drawback is that it has been linked to Reye's Syndrome, a deadly illness associated with viral infections, which is why it's no longer used to treat flu symptoms in children.

Librium

Purpose: Typical anti-anxiety

This mood-altering drug has sedative and muscle relaxation effects. Initially approved as a tranquilizer, librium was the first benzodiazepine to be synthesized and made commercially available. The drug has become part of the recreational drug scene because of one of its compound effects, rohypnol.

Sources: U.S. Food & Drug Administration, www.cancerbacup.org.uk, Pfizer Inc., Physician's Desk Reference, Plumb's Veterinary Drug Handbook, Center for Disease Control, www.Chemistry.org

Top 10 U.S. Pharmaceutical Companies, Ranked By Total Prescription Count (TRx)	
Corporation	TRx Count
Pfizer.....	323 million
Teva Pharmaceuticals.....	209 mil
Novartis	208 mil
Mylan.....	195 mil
Watson Pharma.....	174 mil
GlaxoSmithKline.....	133 mil
Merck.....	112 mil
Abbott.....	101 mil
AstraZeneca.....	92 mil
Johnson & Johnson.....	88 mil

Top 10 U.S. Retail Products, Ranked By Total Prescription Count (TRx)	
Product	TRx Count
Hydrocodone.....	92.7 million
Lipitor	69.8 mil
Lisinopril	46.2 mil
Atenolol	44.2 mil
Synthroid.....	44.1 mil
Amoxicillin	41.4 mil
Hydrochlorothiazide.....	41.3 mil
Zithromax.....	37.2 mil
Furosemide.....	36.5 mil
Norvasc.....	34.7 mil

Source: National Association of Chain Drug Stores



The Freshman Learning Community at Microsoft headquarters during spring break.

The Freshman Connection

By Cecelia Orwig

The secret of a student's success isn't limited to what he or she learns in class—it's also about the connections made with other students.

For freshmen, many of which are overwhelmed by the academic and social challenges of college, finding a group of students to study and socialize with can greatly increase their chances of success.

The university's freshman learning community program helps ease that transition by providing structure to students' new, hectic world. The College of Engineering has had a learning community since 1997. Students live together in Abel Hall, take core classes together and organize study hours. This year's community has 70 students.

"It's easier to make friends in your field," said Ashley Grace, a sophomore mechanical engineering major.

Grace is a learning community mentor who helps guide students through their first year. The other mentors are Jason Schafer, an agricultural engineering

major, and Mike Kohn, a civil engineering major. These upperclassmen are available to answer questions Monday, Wednesday and Friday evenings and organize Sunday study sessions before major exams.

Although the academic services are beneficial, mentors go a step further to make the program fun.

Every September, the learning community hosts the "Steak and Egg"

"It's easier to make friends in your field."

-Ashley Grace, sophomore

event. Freshmen attempt to make eggs survive a drop from the roof of Abel Hall using everyday products such as cotton balls and toothpicks. Later that evening, the students enjoy a fancy steak dinner with engineering faculty members.

Each academic year, the learning community takes one main trip. This year the learning community went to Seattle to tour Microsoft, Boeing, HDR

and the Port of Seattle. They also ate dinner in the Space Needle and went to a Seattle Supersonics basketball game.

"They get to tour industries and major cities, and it's a great way to get to know faculty members," Grace said. "I'm pretty sure there are no other communities that take trips like we do."

She said taking on a leadership role in the community has several perks.

"You help incoming freshmen adjust and you know you're helping them, you get to know the engineering staff, plus you get a stipend and get to go on the trip for free," Grace said of being a mentor.

Mentors may reapply every year until they graduate. They meet once a week with adviser Ann Koopman and plan the many activities students enjoy throughout the year.

Whether a student or mentor, the learning community is a great way to become involved. It has helped young students find their way through the university, and with the help of caring mentors, its benefits will continue.



Seattle Photo Album

1. Members of the Freshman Learning Community and the Dean's Advisory Board visit the Seattle Space Needle.
2. Ashley Grace and Malinda Lammers with a newfound friend at the Seattle Aquarium.
3. Students at a Seattle Supersonics game.
4. Jason Schafer presents Bob Brightfelt, president of the Dean's Advisory Board, with a t-shirt signed by the learning community.



E-Week 2006



Senior civil engineering major Jared Wagner shows E-Week Open House visitors a steel bridge made by the American Society of Civil Engineers.



Students build their Tower of Power at the E-Week Open House, an event that included College of Engineering tours, hands-on activities and demonstrations.

UNIVERSITY OF
Nebraska
Lincoln | NEBRASKA BLUEPRINT

203 Othmer Hall
P.O. Box 880642
Lincoln, NE 68588-0642