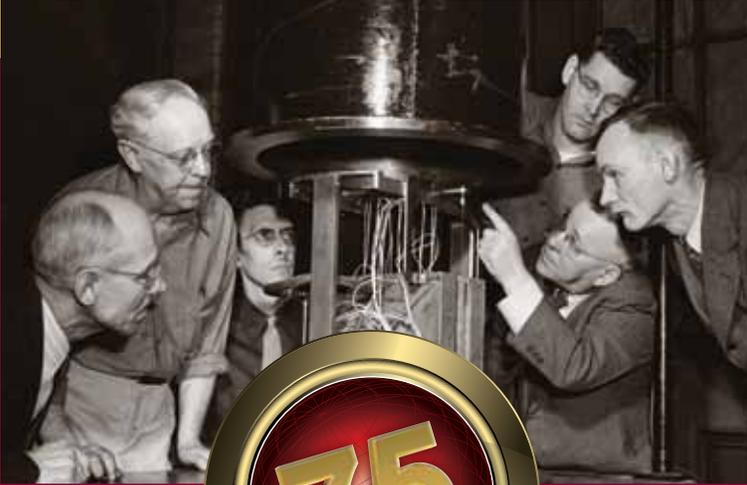
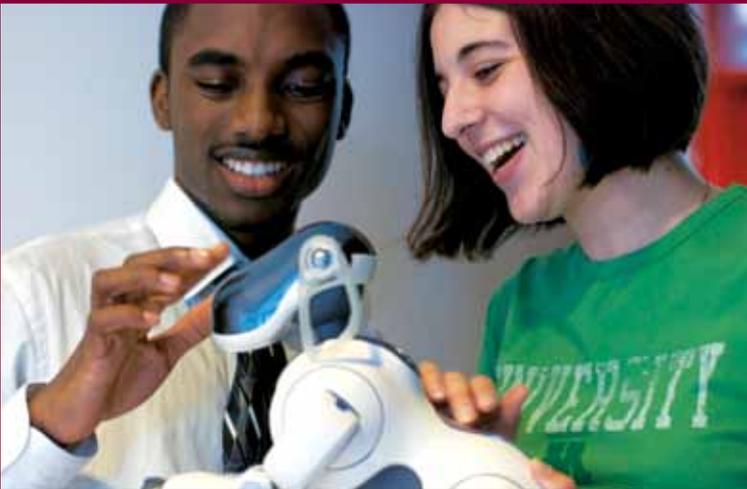
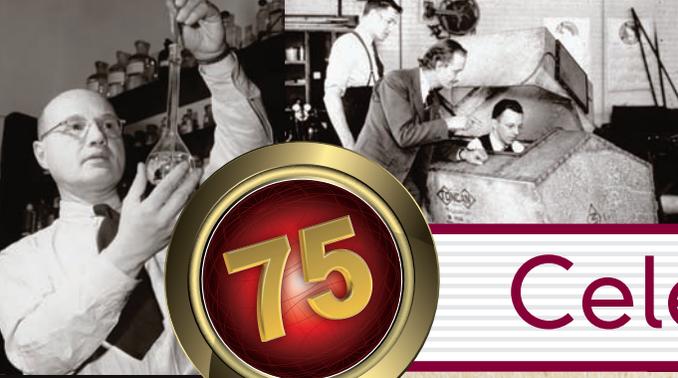


INVENTING TOMORROW



Celebrating our 75th Anniversary





Celebrating 75 years of

INVENTING TOMORROW

Summer 2011
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Special Edition

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FROM THE DEAN
STEVEN L. CROUCH

Rich history shows tradition of success



REFLECTING ON THE past accomplishments of the College of Science and Engineering, I am proud of our strong history. For more than 75 years, the College of Science and Engineering has been a driving force in global problem-solving, economic development, and creating jobs. Our college's founders set a course for success that we continue to build upon today. Worldwide, our alumni have founded more than 4,000 active companies that employ 551,000 people and generate annual revenues of \$90 billion.

In the pages of this special edition of *Inventing Tomorrow*, you will find just a sampling of the college's pioneering innovators who made an impact on the world. Like our early faculty and researchers, our current faculty, research associates, and students are continuing in that tradition. They are developing innovative solutions to help protect the environment; discovering new forms of sustainable energy; developing new cures and technologies for longer and healthier lives; and expanding the powers of information technology.

As we celebrate our achievements over the past 75 years, we look to the future. Our top priority is to expand the number of students we educate in science, technology, engineering, and math, who will lead, innovate, and meet the demands of tomorrow's workplace. Together with our faculty, these are the minds that will revitalize the 21st century economy with new discoveries, industries, and job creation.

Our spirit of innovation and entrepreneurship is alive and well in the College of Science and Engineering. ■





Inventing Tomorrow

The College of Science and Engineering marked its 75th anniversary on Oct. 19, 2010 with a celebration on the University's Northrop Mall and a Leadership event at McNamara Alumni Center.



Lunch served on Northrop Mall



CSE alumni band entertains on Northrop Mall



CSE student speaker Claire Rydeen



University Vice President for Research Tim Mulcahy serves as Master of Ceremonies



CSE students surprise the crowd with a flash mob dance



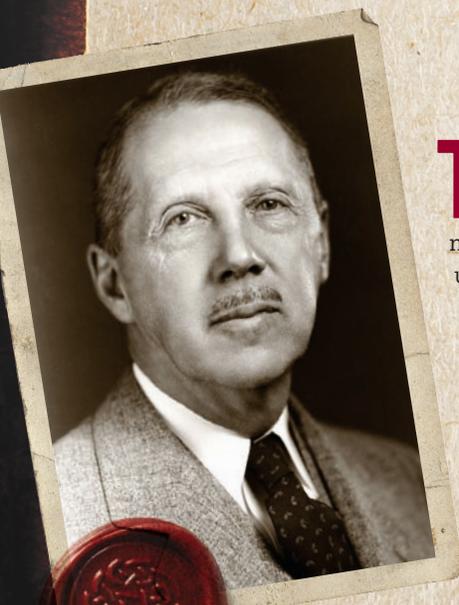
CSE Student Organization Fair



Leadership dinner at McNamara Alumni Center

Yesterday's engineering and physical sciences set the foundation for today's College of Science and Engineering

History



In 1935, Samuel C. Lind became the first dean of the Institute of Technology.

The cornerstone of today's College of Science and Engineering was laid seventy-five years ago, when engineering, architecture, mines, and chemistry were brought together under the direction of Samuel C. Lind. It was Oct. 19, 1935, during the midst of the Great Depression and a period of great turmoil.

First dean of the Institute of Technology

Lind, who had formerly served as the head of the School of Chemistry, became the first dean of the Institute of Technology when then University president Lotus Coffman requested that the School of Chemistry, the College of Engineering, the School of Mines, and the Mines Experiment Station be combined into one larger college named the Institute of Technology. The Massachusetts Institute of Technology was said to have raised an objection to Minnesota's use of Institute of Technology—possibly because MIT was jealous of the acronym that a Minnesota Institute of Technology might claim. Regardless, the name remained until July 1, 2010, when it became the College of Science and Engineering.

During his 21-year tenure, Lind recruited world-renowned faculty members, and increased the University's status as a top research and learning facility. The college opened its doors to approximately 100 faculty members and approximately

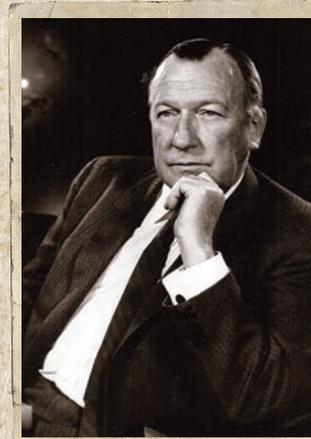
1,974 undergraduate and 266 graduate students, creating a unique and innovative institution.

Over the years, the college has continually evolved as departments and schools have been added and integrated. Sheltering chemistry, engineering, and mining under one umbrella at the University was not initially embraced by all. There was much discussion about how the physical sciences, mathematics, and engineering were interrelated. This became the framework for a change in the nature of science and engineering study at Minnesota.

Following World War II, the Institute of Technology's engineering departments expanded class offerings in basic sciences as part of its core curricula, recognizing that engineering connects science and technology and realizing that expanded basic studies must be interwoven with application and experimentation.

Engineering change

In 1949, Athelstan Spilhaus became dean. With a background in both engineering and science, he was an unconventional man with unconventional



Former Dean Athelstan Spilhaus

CSE Timeline

1869 U of M organized as a land-grant university, with math professor William Watts Folwell as its first president.

1870 The Mathematics Department established in the School of Science, Literature, and the Arts.

1870 Minnesota Geological Survey established.

1872 Department of Geology and Geophysics (renamed Department of Earth Sciences in 2011) established.

1884 College of Engineering organized.

1888 School of Mines established (renamed School of Mines and Metallurgy in 1927).



Chemistry laboratory in 1932.

ideas. He saw science and mathematics as fundamental to engineering education and practice. Spilhaus believed that the three supports of physical science—chemistry, mathematics, and physics—were equally important in educating students in the Institute of Technology. The college already had chemistry and mathematics, but wanted to include physics in the mix.

A year after taking his post, Spilhaus floated the idea of moving the physics department into the Institute of Technology. Professor and physics chairman J.W. Buchta strongly resisted the idea saying that such a transfer would subordinate physics to engineering and basic science to applied research, compromising its academic and professional status.

When Alfred O.C. Nier succeeded Buchta in 1953 as physics chairman, Spilhaus gained an ally in the proposed merger. Nier (EE '31, M.S. '33, Physics Ph.D. '36) had been a National Research Council fellow at Harvard, where he built a high-precision mass spectrometer that first separated the fissile isotope of uranium (U-235) from the much more abundant U-238. Nier recognized that a transfer from the University's College of Science, Literature and Arts to the Institute of Technology could be advantageous since the department's particle accelerators required extensive engineering support. Not only was IT accustomed to managing government grants available to physics, booming enrollments and IT curricula had increased the department's teaching burden. Finally, by 1956, the physics

faculty endorsed the move to the Institute of Technology.

Discussions were also under way during this period about uniting the natural sciences within a new College of Science. In 1960, faculty from botany and zoology proposed creating an Institute of Sciences, to be located within the Institute of Technology. Many said the natural sciences had more in common with departments in the Institute of Technology than the College of Science, Literature and Arts. Others noted that the biological sciences had closer ties with the medical school and agricultural college than with the Institute of Technology. This difference weakened the argument for creating an Institute of Science within the Institute of Technology. Ultimately, in 1962, the College of Science, Literature and the Arts (SLA) became the College of Liberal Arts and lost the remaining natural science departments to the Institute of Technology and, in 1965, to the College of Biological Sciences.

The most controversial move—consolidating the SLA and IT math departments—presented then University President O. Meredith Wilson with a dilemma. According to Wilson, there was no easy way to comfortably merge the two departments. Yet in 1963, the two mathematics departments combined to form the School of Mathematics. Architectural Engineering had originally been a part of the Institute

COLLEGE LEADERSHIP

SAMUEL LIND
DEAN, 1935–47

THOMAS TEETER
INTERIM DEAN, 1947–49

ATHELSTAN SPILHAUS
DEAN, 1949–67

FRANK VERBRUGGE
INTERIM DEAN, 1967–68

WARREN CHESTON
DEAN, 1968–71

RICHARD SWALIN
DEAN, 1971–77

WALTER JOHNSON
INTERIM DEAN, 1977–79

ROGER STAEHLE
DEAN, 1979–83

V. RAMA MURTHY
INTERIM DEAN, 1983–84

ETTORE INFANTE
DEAN, 1984–91

GORDON BEAVERS
INTERIM DEAN, 1991–93

FRANCIS KULACKI
DEAN, 1993–95

WILLARD MILLER
INTERIM DEAN, 1995

H. TED DAVIS
DEAN, 1995–2005

STEVEN L. CROUCH
DEAN, 2005–PRESENT

1890 Physics Department established.
1899 Pillsbury Hall completed.

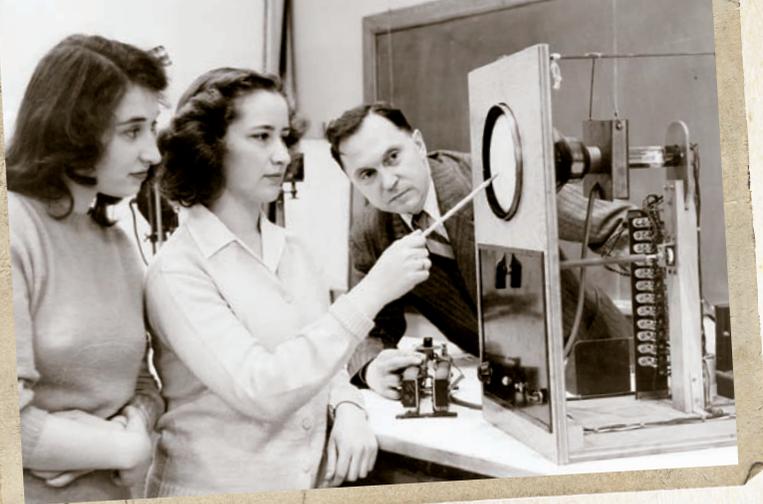
1890 Geology and Geophysics Department (now Earth Sciences) moves into the newly constructed Science Hall, later named Pillsbury Hall, where it remains today.

1891 Electrical Engineering Department established.

1892 Astronomy Department established.

1893 Chemistry Department established.

1894 Mathematics Department established in the College of Engineering.



Chairman of the Physics Department from 1938 to 1953, J. W. Buchta works with physics students on the electron microscope in 1945.



of Technology, but this department eventually merged into the department of architecture, and was soon joined by the department of landscape architecture.

The School of Earth Sciences was established in 1962 following geology's transfer from the College of Science, Literature and the Arts to the Institute of Technology. Astronomy was also transferred from the College of Science, Literature and the Arts in 1962. After 18 years at the helm, Spilhaus resigned as dean in 1967 after setting the college's unique structure in place. The college today still combines, administratively, all of the teaching, research, public service of both basic and applied engineering with the basic science of physics, chemistry, geology, mathematics, and computer science.

Additionally, the college's distinctly interdisciplinary approach to science and engineering not only integrated diverse departments, it spawned two dozen centers and institutes to bring physical sciences, mathematics, and engineering to bear on multidisciplinary and industrial research.

In the 1970s and 1980s, the college's Department of Computer Science (now the Department of Computer Science and Engineering) was instrumental in helping to develop the early computer industry in Minnesota. During the same period, Neal Amundson, who served as head of the college's Department of Chemical Engineering, and became known as "the father of modern chemical engineering," helped to build the De-

"Few programs in the country have the tradition, the industrial environment, the faculty leadership, and the proximity of the medical school and engineering school that Minnesota has."

—William R. Brody
FORMER PROVOST ACADEMIC HEALTH CENTER

partment of Chemical Engineering and Materials Science into a powerhouse among chemical engineering departments, which it remains today.

The first graduating class in 1935 was 20 students. In 2009-10, the college granted 1,081 bachelor's degrees, 506 master's degrees, and 198 doctoral degrees. Student enrollment for Fall 2010 included 4,857 undergraduates and 2,674 graduate students. For Fall 2011, more than 9,000 applications were received for 925 openings!

The college employs approximately 400 tenured and tenure-track faculty members who received their professional training in 90 different universities worldwide. This faculty includes 10 National Academy of Engineering members, and four National Academy of Sciences members, as well as six Regents professors.

Today, the college is comprised of 12 academic departments offering a wide range of degree programs in engineering, science, and mathematics, which are tailored for the careers of today and tomorrow. Above all, our faculty, research associates, and students are among the best at the University. Our incoming freshman students' average ACT score is 30.1. Researchers in our college are leading the way in finding solutions to pressing global problems such as energy security, the environment, human health, and infrastructure. ■

The Department of Mechanical Engineering is the largest in the College of Science and Engineering. The department annually grants approximately 180 bachelor's degrees. There are more than 11,000 living mechanical engineering alumni. More than 655 have founded one or more companies worldwide.

CSE Timeline

1898
1909
1910
1911
1912
1913

Mechanical Engineering Department established.

Biosystems and Agricultural Engineering (later renamed Bioproducts and Biosystems Engineering) Department established.

Civil Engineering Department established.

Experimental Engineering Building completed.

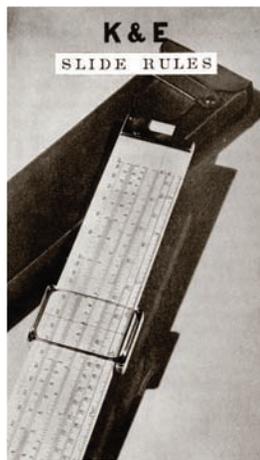
Main Engineering Building completed (renamed Lind Hall in 1975).

Agricultural Engineering Building completed.

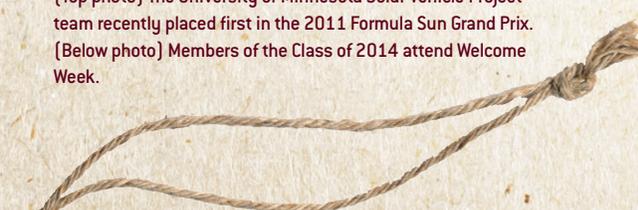


[Top photo] The University of Minnesota Solar Vehicle Project team recently placed first in the 2011 Formula Sun Grand Prix.
[Below photo] Members of the Class of 2014 attend Welcome Week.

In existence for 137 years, the Department of Earth Sciences (formerly the Department of Geology and Geophysics) is the oldest unit in the College of Science and Engineering. Pillsbury Hall, built in 1887 and the second oldest building on the Twin Cities campus, has been home to the department its entire existence.



In 1940, the distinguishing mark of an engineer was a slide rule. The beginner's favorite sold for \$2.50.



Award-winning Minneapolis sculptor Andrew Leicester, created the 35-foot-tall, 6,000-pound stainless steel statue in 2001 that stands as an icon for the College of Science and Engineering. Sitting on seven-foot limestone columns in the courtyard between Lind Hall and the Mechanical Engineering Building, the statute was designed as a tribute to Leonardo da Vinci's famous drawing "Vitruvian Man."



1914 Chemistry Building completed (renamed Smith Hall in 1971).

1914 First Engineering Day celebrated on St. Patrick's Day. The annual celebration (which became Engineering Week in the 1950s, IT Week in the 1980s, and CSE Week in 2011) has been held continually for nearly 100 years.

1919 Chemical Engineering Department established.

1924 Old Electrical Engineering Building and Main Library completed (library renamed Walter Library in 1959).

Women

in Science and Engineering



The first women to graduate from the College of Engineering and Architecture were Ursulla Quinn and Esther Knutsen, both civil engineering majors, in 1925.

More than 90 years have passed since the first women entered the College of Science and Engineering. Over the decades, public opinion, personal experiences, and the percentages of women in scientific and technological disciplines have changed considerably.

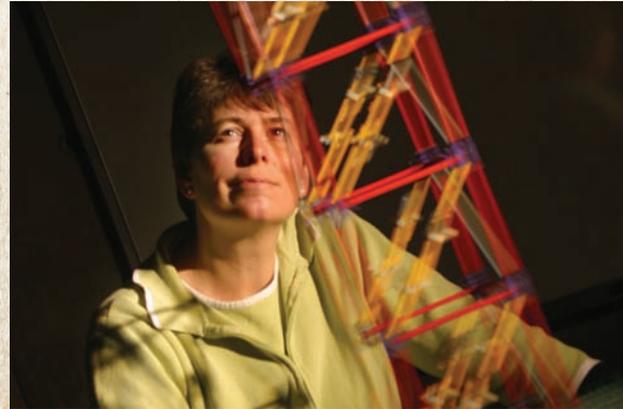
The pioneering women who first entered the Institute of Technology won respect for their academic achievements, but they were warned not to expect successful careers.

Betty Sullivan (Chem '22), one of the first women to major in chemistry and chemical engineering, entered the college at age 16 in 1918. Sullivan, who rose to become president of a consulting company, had no trouble finding a job after graduation because World War I helped to create opportunities for women in the workforce.

According to a 1924 *Technolog*, the college's student publication, the men at a civil engineering summer field camp were apprehensive about the presence of two female students, Ursulla Quinn and Esther Knutsen. However, the article notes that the women "proved themselves to be mighty good sports, shirking no duties and performing their work with accuracy and speed."

Roberta Humphreys, professor of astronomy, (next page) was the first woman to be named an Institute of Technology Distinguished Professor in 2001, followed by Catherine French (top) professor of civil engineering, in 2006, and Maria Gini (bottom) professor of computer science and engineering in 2008.

The percentage of women in engineering grew slowly, from less than two percent of students in the Institute of Technology's early years to 13 percent in the early 1980s. This past fall 2010, the number of first-year female students reached an all-time high with 232 female students or 25.4 percent. ■



CSE Timeline

- 1927** Former faculty member Arthur Compton wins the Nobel Prize in physics.
- 1928** Physics Building completed (renamed Tate Laboratory of Physics in 1965).

- 1929** Department of Aeronautical Engineering established.

- 1935** Institute of Technology is created by consolidating engineering, architecture, mines, and chemistry. Samuel Lind named the college's first dean.

- 1938** Vincent Hall (current home of Mathematics) and the St. Anthony Falls Laboratory completed.

- 1939** Alumnus Ernest Lawrence (Physics '23) wins the Nobel Prize for developing the cyclotron.



Chemistry co-eds are shown making soap in 1930.

According to U.S. Census data, in 1966—the first year such statistics were kept on gender—women earned so few engineering degrees that from a statistical perspective, they didn't even exist. In 2003, women accounted for slightly more than 10 percent of all working engineers.

“Although the fellows accepted us, it just didn’t make sense to them. Women [who worked outside the home] were expected to be book-keepers, teachers, or nurses—not engineers.”

—Roberta (Huston) Cronquist
ChemE '47



During the 1930s, although the number of female students was still small, chemistry was among the most popular majors for women.

“Women in IT in the 1940s were treated pretty well, but they weren’t welcomed with open arms. Engineering was a male-dominated field, and men weren’t necessarily prepared to deal with women as colleagues.”

—Alice (Jarvis) Klein
CivE M.S. '51



Roberta Humphreys

1940 Professor Alfred O. C. Nier (Electrical Engineering '31) established uranium 235 as the isotope responsible for nuclear fission.

1946 Professor E. W. Davis develops large-scale commercially successful taconite process.

1948 Mechanical Engineering Building and Akerman Hall completed.

1949 Chemical Engineering Building completed (renamed Amundson Hall in 1970).

1956 Alumnus Walter Brattain (Physics '27), former faculty member John Bardeen, and William Shockley win the Nobel Prize for inventing the transistor.

Serving the War Effort



Like everything else in the United States, life at the University of Minnesota changed drastically in 1941. Intense military training programs gave the campus the look of a military base populated by hundreds of young men and women in uniform.

Faculty members turned their research energies to the war effort. Chemistry professor Izaak Kolthoff, for example, helped to develop improved techniques associated with producing synthetic rubber, as part of a government research team. Using cutting-edge analytical techniques, he and colleague Edward Meehan made important breakthroughs in understanding the emulsion polymerization method of making synthetic rubber.

As the war grew more intense, campus training declined as trainees were called to more active forms of duty. Class sizes diminished as some students—including those in mechanical engineering—were asked to set aside their studies to work in factories, helping local companies fill their contracts for war materials.

The war effort brought new heights of industriousness and technological achievement. Many individuals and companies who first tested their wings during the war soared to even greater heights in peacetime.



Chemistry professor Izaak Kolthoff



Curtiss-Wright Cadettes, 1943

Women join forces

In 1943, the University of Minnesota joined an ambitious project called the Curtiss-Wright Program. Seven universities and colleges joined together to train approximately seven hundred women—about one hundred at each institution—to work as engineers at aircraft manufacturing plants nationwide.

During the first year, 102 women were selected to study aeronautical engineering. Called the Curtiss-Wright Cadettes, these women were employees of the Curtiss-Wright Corporation and were pledged to work in engineering departments of that company after graduation.

They took courses in drawing, structures, mechanics, aerodynamics, machine shop, materials testing, and aluminum fabrication. In the 10 months, the students earned approximately two and one half years of college credit in engineering subjects.

CSE Timeline

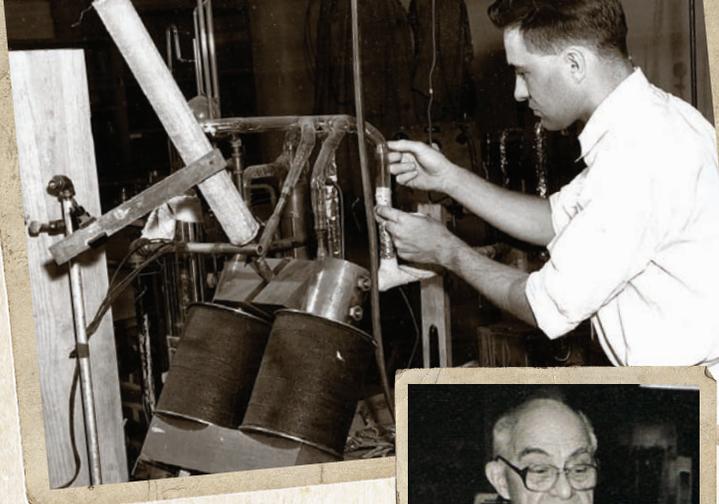
1957 Mines and Metallurgy Building completed (annexed to Amundson Hall in 1970).

1958 Alumnus Earl Bakken (Electrical Engineering '48) designs the first battery-operated heart pacemaker.

1960 Mechanical engineering professor James Ryan obtains patent for a first-generation "Black Box" flight recorder.

1961 Melvin Calvin (Chemistry '35) wins the Nobel Prize for his work in photosynthesis using Carbon 14.

1962 President O. Meredith Wilson launches a major University reorganization: College of Science, Literature, and the Arts (SLA) becomes the College of Liberal Arts.



Physics professor Alfred O.C. Nier

Nearly 100 Cadettes completed the course and went on to Columbus, Ohio in December of 1943. The success of the cadettes provided an innovative solution to the aircraft company's dwindling supply of graduate engineers.



Successful innovation

Professor Alfred O.C. Nier (physics) will forever be remembered as the physicist whose pioneering research on uranium isotopes helped usher in the atomic age. Nier, who died at age 82 in 1994, was the first scientist to devise a method of isolating uranium 235, the fissionable form of uranium. His research provided the Manhattan Project scientists with the breakthrough they needed to develop the atomic bomb.



Electricians mates were trained to operate electrical systems on battleships and submarines.

After graduation, Walter Spivak (Aero '36) landed a job with Boeing where he worked on the mechanical design of the F-26 fighter plane. Eventually moving to North American Aviation, he became project engineer for the B-25 bomber in 1940. Within a month of the first test flight,

he and his team had the plane in full production. The success of the B-25—along with the escalation of U.S. involvement in the war—created a huge demand for the planes.

From 1942 to 1945, the electrical engineering department trained more than 3,000 electrician's mates. Every two weeks a new company of 125 recruits would arrive, fresh out of boot camp. In 16 weeks, the electrical engineering faculty would teach them all they needed to know to operate the electrical systems on a battleship, cruiser, or submarine.

The military turned to chemical engineer Edgar Piret (ChemE '32) to process and package millions of K-rations for the war. He invented and patented a molded dehydrated meat product claimed to be "delicious and nutritious." ■

"A turning point in engineering education [took place] because one of the things that became obvious in World War II and the [invention] of radar is it was not done by electrical engineers; it was done by physicists."

—W. G. 'Jerry' Shepherd
FORMER IIT ASSOCIATE DEAN
1954-56



Walter Spivak
Aero '36

Paul Cartwright, long-time electrical engineering professor and former assistant dean for student affairs, was hired to train young Navy recruits to become electrician's mates. By the end of the war, Cartwright had helped to train more than 3,000 naval mates.

1962 Geology and astronomy transferred from SLA to Institute of Technology; physics and astronomy brought together to establish School of Physics and Astronomy.

1963 Mechanical engineering professor James Ryan obtains patent for the first automatic retractable automobile seat belt.

1970 School of Mines and Metallurgy closes; its programs are transferred to the reconfigured Departments of Chemical Engineering and Materials Science and Civil Engineering.

Department of Computer Science established.

Pioneering Innovators

Impact The

For the past 75 years, the College of Science and Engineering has pioneered research, innovation, and technology transfer to Minnesota and the world.

The people behind this unique institution developed the country's first computer industry, harnessed hydroelectric power, extracted iron ore from the earth, and designed a generation of airplanes.

In these pages are only a small sampling of innovations that have addressed global issues and established new industries. The college today continues to transform society and individual lives as never before through its groundbreaking research and record of success.

“People are the fundamental product of the [college]. It's not the technologies that might be created. It's the people who then go out and get involved in businesses and start new businesses, creating jobs.”

—Arthur Kydd
Aero '60

MINNESOTA HIGH TECH
ASSOCIATION FOUNDER

Pioneering safety

Mechanical engineering professor James Ryan was nick-named “Crash” for a reason. He and a graduate student once tested safety equipment by personally crashing a modified Ford into a brick wall. These unconventional efforts revolutionized transportation safety.

Ryan's early research focused on aviation safety. In the 1940s, he developed a first-generation “black box” flight recorder. He turned his attention to automobile safety and explored many safety modifications, including hydraulic bumpers, seat belts, padded steering wheels, and new dashboard designs.

In 1963, he obtained a patent for an automatic, retractable safety belt. As a result of his research,

the National Highway Traffic Safety Administration was created in 1970 to set safety standards for all vehicles and their components.

Managing water resources

While the University first explored developing a civil engineering hydraulic laboratory at St. Anthony Falls in 1908, it was not seriously pursued until Lorenz G. Straub came to the University in 1930. He envisioned a University-based institute



[Top] Professor James Ryan and medical-school researcher Grafton Smith, 1950



[Bottom] Professor James Ryan testing automobile safety, 1957

CSE Timeline

1971 UNITE Instructional Television debuts.

Kolthoff Hall (chemistry) completed.

1972 Alumnus Seymour Cray (Electrical Engineering '49) founds Cray Research and leads development of supercomputers.

Former faculty member John Bardeen wins his second Nobel prize in physics, for developing the theory of super-conductivity.

1975 Astronaut Donald K. “Deke” Slayton (Aero '49) commands Apollo-Soyuz space mission.

World

Worldwide, College of Science and Engineering alumni have founded more than 4,000 active companies that employ more than 551,000 people and generate approximately \$90 billion in annual revenue. Many of these entrepreneurs agree that their education at CSE played a crucial role in their success.

that would not only serve as a place of education, but as a place to pioneer new methods in water resources management.

In 1935, through the Works Progress Administration, the University began constructing the lab on Hennepin Island. Completed in 1938, the lab allowed researchers to use the Mississippi River's natural 50-foot drop at the falls to route water for experimental models throughout the building.

Engineers at SAFL have contributed to some of the world's largest hydropower and irrigation projects of the last century, such as Mangla Dam in West Pakistan, Guri Dam in Venezuela, and Egypt's Aswan Dam.

Today, University scientists and engineers develop innovative solutions to the world's water and energy-related problems. It's the only lab in the world where the river really does "run through it." Researchers apply their expertise in fluid dynamics to a wide range of concerns, such as optimizing renewable energy resources, restoring rivers and deltas, investigating impacts of climate change on lakes and streams, and improving designs for life-saving medical devices.

Saving an industry

Professor Edward W. Davis and the Mines Experiment Station saved Minnesota's iron-mining industry by developing a new industry based on



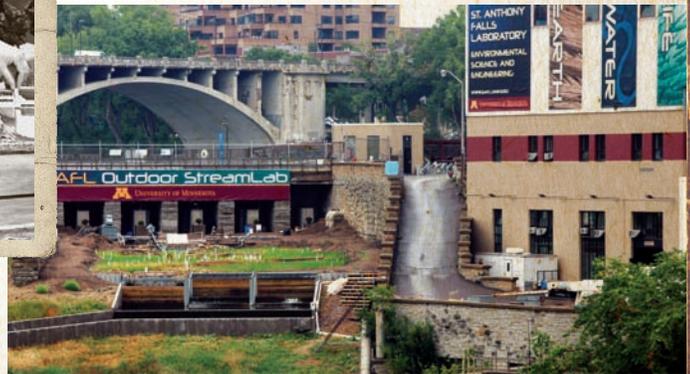
Lorenz Straub, 1932

"Engineers are well suited to be risk-takers. They deal well with complexity. Always looking at better ways of doing things is part of their education. The idea of change doesn't scare them."

—Erwin Tomash

EE '43

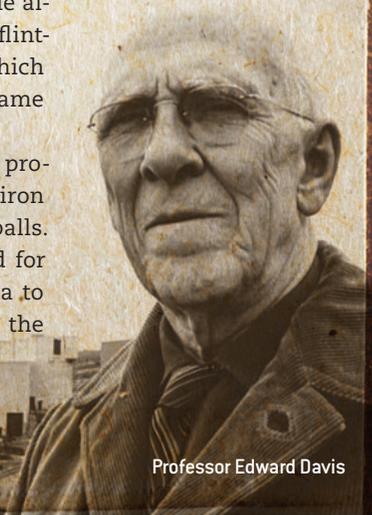
DATAPRODUCTS CORP. FOUNDER



SAFL Outdoor Stream Lab opens in 2008

taconite. When Minnesota's rich soft hematite ore began to run out, a commercially viable alternative was needed. Taconite, a hard, flint-like rock containing low-grade iron ore, which was abundant in northern Minnesota became the answer.

Davis devised a two-stage "pelletizing" process to extract and upgrade the ore. The iron then is formed into marble-sized taconite balls. His method became an industry standard for iron ore worldwide, and helped Minnesota to remain the leading source of iron ore in the United States.



Professor Edward Davis

1977 Former faculty member John Van Vleck and two others win the Nobel Prize in physics for their contribution toward understanding how electrons behave in magnetic, noncrystalline solid materials.

1983 Civil Engineering Building completed, extending seven stories below ground.

1987 Center for the Development of Technological Leadership (now called the Technological Leadership Institute) established.

1988 Electrical Engineering/Computer Science Building (renamed Keller Hall in 2010) completed on the site of the old Experimental Engineering Building.

Newton Horace Winchell School of Earth Sciences dedicated in honor of Winchell, the Minnesota Geological Survey founder.

in 1936 Jean and Jeanette Piccard invented a cellophane balloon, which was launched in Memorial Stadium.

“We have strong, highly diversified research going on here that relates to everything from the design of products and processes for industrial applications to fundamental research on the decay of protons. That’s something you don’t find in most colleges of engineering and science.”

—Frank Kulacki
DEAN FROM 1993-95

Rosemount Aeronautical
Engineering site, 1957



Taking flight

After World War II, the University acquired an 8,000-acre gunpowder plant south of Minneapolis, which would serve as the Aeronautical Engineering department’s primary research facility. This became the site of the Rosemount Aeronautical Laboratory (RAL). Faculty members designed and installed a number of wind tunnels at Rosemount, including a hypersonic tunnel capable of producing speeds between Mach 7 and 11 and air temperatures of 3,000 degrees Fahrenheit.

The RAL was the site of significant research for both industry and the military. Several successful ventures were spun off from RAL, including Rosemount Engineering Company, which produced a total temperature sensor for the Navy, widely used in jet aircraft. The company became one of the world’s largest suppliers of air data and other flow sensors. Several other spin-offs, including Research Incorporated, MTS Systems Corporation, and Fluidyne Engineering Corporation (now Phoenix Solutions) also originated at Rosemount.

Soaring into the stratosphere

In October 1934, Jean and Jeanette Piccard stepped into a pressurized, airtight gondola of a balloon and launched themselves into history, soaring to a record altitude of 57,979 feet.

Piloted by Jeanette Piccard, the flight proved that humans could tol-

erate ascents into the frigid stratosphere with gondolas and balloons designed to withstand the low pressure of the upper atmosphere. During that flight, they carried out cosmic ray research and also tested a liquid oxygen system. The technology would lay the groundwork for manned space flights decades later.

One of Piccard’s first projects, after joining the University’s faculty in 1936, was to construct an unmanned hydrogen-filled transparent cellophane balloon designed for ascents 10 to 14 miles into the stratosphere. Launched from Memorial Stadium in 1936, it rose more than 50,000 feet and traveled nearly 600 miles, landing in an Arkansas field.

Race for space

During the era of lunar landings and planetary exploration, a modest building on the Minneapolis campus was the site of important space science research. When opened in 1969, the Space Science Center was the state’s only academic



Jean and Jeanette Piccard

CSE Timeline

1989 School of Architecture and Landscape Architecture separates from the college, becoming the College of Architecture and Landscape Architecture.

1993 IT alumni mentor program brings more than 10,000 Minnesota school children to campus during “Building a New World” project.

1997 Basic Sciences/Biomedical Engineering Building (renamed Hasselmo Hall in 2005) completed.

1998 Digital Technology Center established.

UNITE begins offering courses by streaming video over the Internet.

research facility devoted principally to space and science technology.

After the Apollo II moon landing in 1969, earth sciences professor emeritus V. Rama Murthy and physics professor emeritus Robert Pepin were some of the first scientists to have access to lunar samples brought back by the astronauts.

Creating an industry

The stage for current collaborations among engineers, biologists, and materials scientists in studies of new biomaterials and medical devices was set more than 60 years ago at the University of Minnesota Hospitals. Earl Bakken (EE '48) was a young electronic repairman when pioneering heart surgeon C. Walton Lillehei asked Bakken to help him solve a problem he was having in keeping pacing equipment operating during electrical blackouts. The upshot of their conversation was Bakken's invention of the cardiac pacemaker, the birth of Minnesota's medical technology industry, and the start of Medtronic, Inc.

Landings legend

Helmut Heinrich, a professor in the Department of Aerospace Engineering and Mechanics for almost 25 years, developed supersonic parachutes that contributed to the Apollo space land-



Aeronautical engineering lab, 1941

ings in the 1970s as well as parachute systems that were used in the soft-landing technology of the Mars and Venus probes of his era. Heinrich's knowledge of parachutes was encyclopedic. In addition to design efforts for the space program, he also designed parachutes for use in skydiving.

Warm and dry

Robert Gore (ChemE Ph.D. '63) says he spent some of the best years of his life at the University. "We had the freedom to explore. There was a free give-and-take of ideas," said Gore, chairman of W.L. Gore & Associates. Inspired by the natural and academic climate at the University of Minnesota, Gore's graduate research in chemical engineering led to his invention of the GORE-TEX® fabric that keeps millions warm and dry around the world.

Controlling traffic

One of the Department of Electrical Engineering's earliest research and development projects involved traffic control equipment, which included a device that allowed drivers to regulate the duration of red and green light on semaphores by blowing their horns. ■

(Left) Earl Bakken, Medtronic founder, at work in his northeast Minneapolis garage in 1949.

(Right) Electrical Engineering Traffic Control laboratory in 1929.



"Perseverance is the key. Work hard and be optimistic."

—from an article about starting a new business in the 1991 summer issue of *Inventing Tomorrow*



Helmut Heinrich, professor of Aerospace Engineering and Mechanics



Robert Gore, ChemE Ph.D. '63

2000 George T. Piercy Molecular Materials Wing of Amundson Hall completed.

Biomedical Engineering Department established.

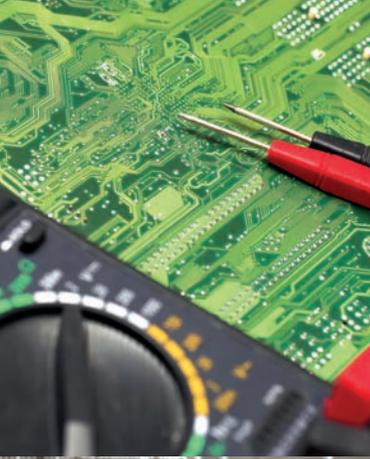
2000 The college hosts first annual Medical Devices Conference.

2001 Alumnus Daniel McFadden [Physics '57, Behavioral Sciences Ph.D. '62] and University of Chicago economist James Heckman earn the Nobel Prize in economics for their contributions to microeconometrics

Renovation and expansion of Mechanical Engineering Building is complete.

The DIGITAL

Age



Digital technology pervades every aspect of modern life. From home entertainment systems, Internet commerce, and cell phones to the high-speed computers and powerful software used to design machinery, vehicles, buildings, and clothing, digital technology has revolutionized industry, entertainment, education, and commerce.

The history of computing in Minnesota can be traced back to the post-war era when Engineering Research Associates (ERA) in St. Paul was developing some of the most advanced computers.

Co-founded by computer pioneer and visionary William Norris, and employing numerous engineering graduates of the University of Minnesota, including Seymour Cray, ERA was a dominant player in the budding computing industry. Several computer industry powerhouses can be traced to ERA, including Sperry-Univac, Control Data Corporation (CDC), and Cray Research.

On the University campus, there was growing interest in computing and its application to mathematics, physics, chemistry, and economics. Several departments were using the University's Reeves Electronic Analog Computer (REAC)—state-of-the-art in 1949. The REAC was in constant demand and it soon became clear that the University needed to expand its resources. In 1955, Sperry-Univac, a company formed by the merger of ERA and Eckert-Mauchly Computer

Corporation, gave the University a gift of 400 usage hours on the ERA 1103, which sparked the beginning of the Department of Computer Science and Engineering.

To manage the new gift and other computing resources, the University hired Marvin L. Stein, a professor of mathematics with a Ph.D. from UCLA's Institute for Numerical Analysis. He immediately began to develop and instruct the first courses in high-speed computation, which shaped the path of the University's computer science curriculum.



Dean Athelstan Spilhaus (left) visiting University computing facility in 1950.

Institute of Technology Dean Frank Verbrugge (standing) looks on as Professor Marvin Stein demonstrates the Control Data 6600 in the 1960s.

Today's CSE students are equipped with portable laptop computers and other mobile hand-held devices. Wireless Internet access is available throughout campus.

CSE Timeline

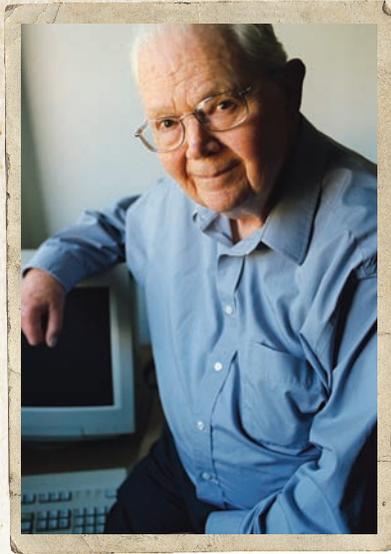
2002 The college becomes a five percent partner in the Large Binocular Telescope (LBT), one of the most powerful on Earth.

Walter Library reopens after a two-year renovation and restoration.

2005 The college's Institute for Mathematics and its Applications receives \$19.5 million over five years, the largest single math research grant ever made by the National Science Foundation.

2005 The college receives a \$15 million, five-year grant to establish an Engineering Research Center for Compact and Efficient Fluid Power in collaboration with seven universities and more than 50 industry partners.

University interest in computing continued to grow, as it acquired its first digital computer in 1958—a UNIVAC 1103—housed in the Numerical Analysis Center in the Experimental Engineering building, a site now occupied by the Departments of Computer Science and Engineering (CS&E) and Electrical and Computer Engineering (ECE). The acquisition of additional computers led to increased computer use on campus and additional computer classes offered by the college's School of Mathematics.



Marvin Stein, Professor Emeritus

About the same time, the core ERA founders left Sperry-Univac to form Control Data Corporation. At CDC, Cray was the chief engineer for the CDC 1604, launched in 1960 as the first commercially successful transistorized computer. Cray then moved a design team to Chippewa Falls, Wis., where they created the first supercomputer, the CDC 6600. By 1967, the company

sold 63 machines, priced at between \$5 and \$10 million each. That year, the University of Minnesota, with help from the NSF, became the third university to buy a CDC 6600 at a reduced price of \$3.4 million. The CDC 6600 was so successful it propelled the company, Cray, and Minnesota to international prominence in computing. ■

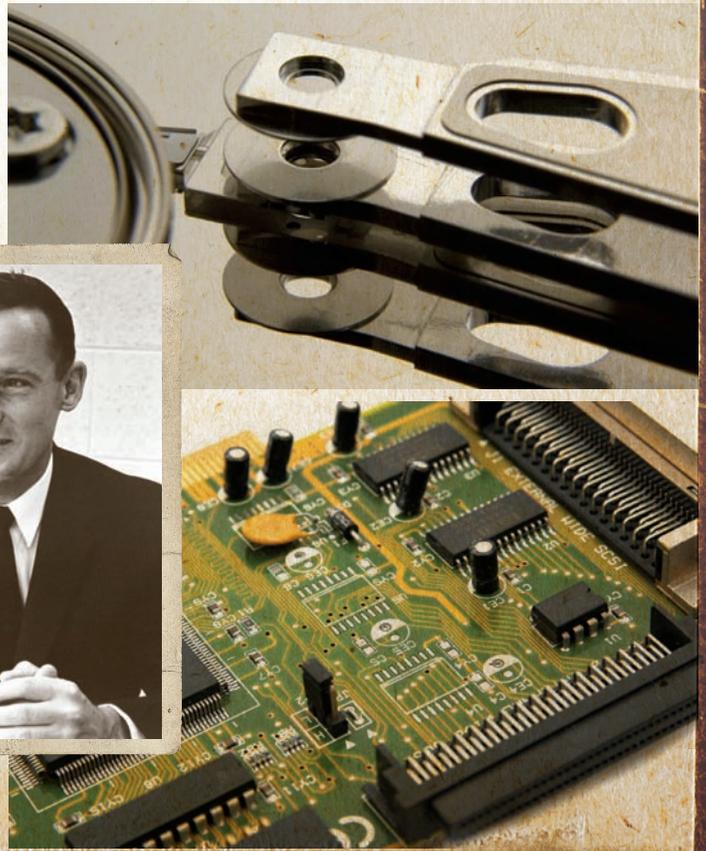
The Computer Science and Engineering department has grown to almost 40 faculty members who provide leadership and expertise in nearly all areas of computer science and engineering.
Computer science and engineering alumni have founded more than 180 companies.

“People didn’t think that working on machines to solve problems was a good idea.”

—Marvin Stein
COMPUTER SCIENCE AND
ENGINEERING DEPARTMENT
FOUNDER

“I was fortunate in having an instructor at the University of Minnesota who was looking after me. When I said, ‘What’s next?’ he said, ‘If I were you, I’d just go down the street here to Engineering Research Associates, and I’d think you’d like what they’re doing there.’”

—Seymour Cray, EE '49
FATHER OF THE SUPERCOMPUTER



2005 The college conducts a survey that reveals its alumni have founded approximately 4,150 companies worldwide that employ more than 500,000 people and generate \$90 billion in annual revenues.

2006 The college launches a nanotechnology initiative establishing a Center for Nanostructure Applications that will bring together researchers University-wide to focus on emerging applications of nanotechnology.

2008 The University opens state-of-the-art Medical Devices Center research laboratory facility.

Inventing Tomorrow

Today

In an era of unprecedented global challenges, researchers within the College of Science and Engineering are finding solutions to some of the world's greatest problems. Here are just a few examples.



Jane Davidson

Mechanical engineering professor **JANE DAVIDSON** is researching the potential of using concentrated solar energy to produce synthetic hydrocarbons that have properties equivalent to what we are deriving from petroleum today. This sunlight to fuel process would allow us to use conventional automobiles and existing road infrastructure.

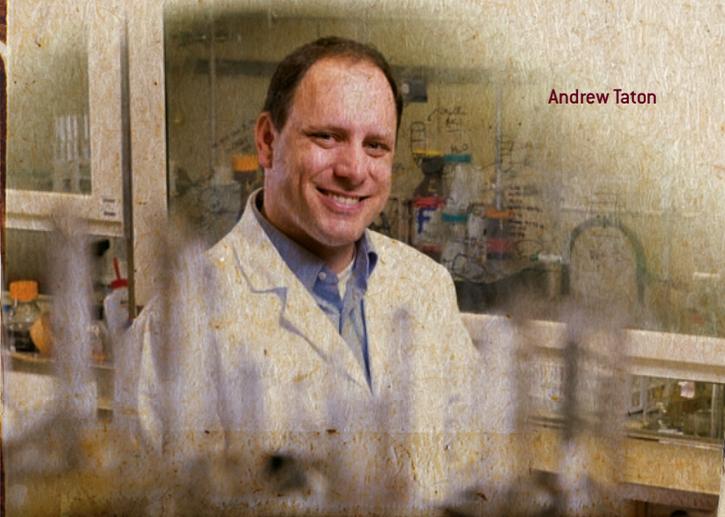
ANDREW TATON, associate professor of chemistry, is working to find general chemistries that connect nano-objects to biological molecules. He is working to create a vaccine that uses nanoparticles coated with proteins that will fool T cells into thinking the particles are cancer cells.

Electrical and computer engineering professor **EMAD EBBINI** led a research team that has developed new medical technology licensed by a Minnesota startup company. The technology uses high-intensity focused ultrasound to treat clogged arteries in a noninvasive manner that is faster, more precise and safer for the patient.

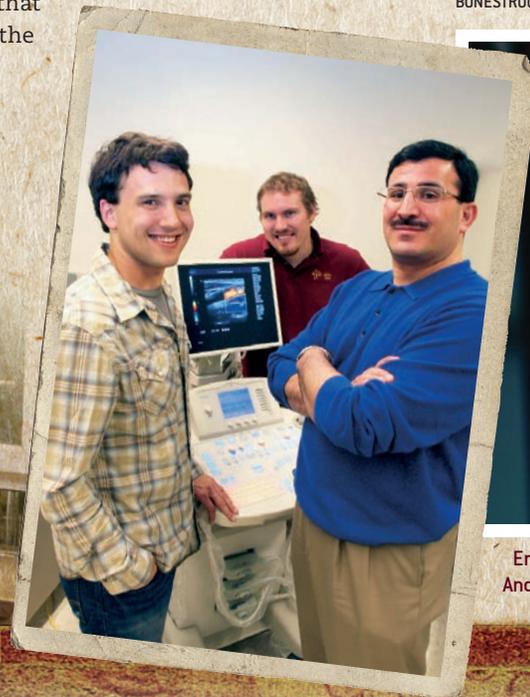
"The College of Science and Engineering is an absolutely essential element of the State of Minnesota economy. The college has got to be strong if we are to keep the economy strong."

—Robert Rosene
CivE '45

BONESTROO, ROSENE, ANDERLIK FOUNDER



Andrew Taton



Emad Ebbini with researchers, Andrew Casper and John Ballard

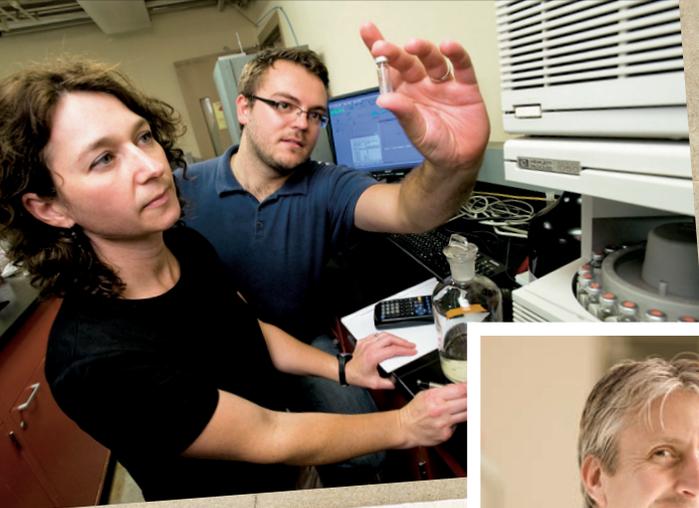


CSE Timeline

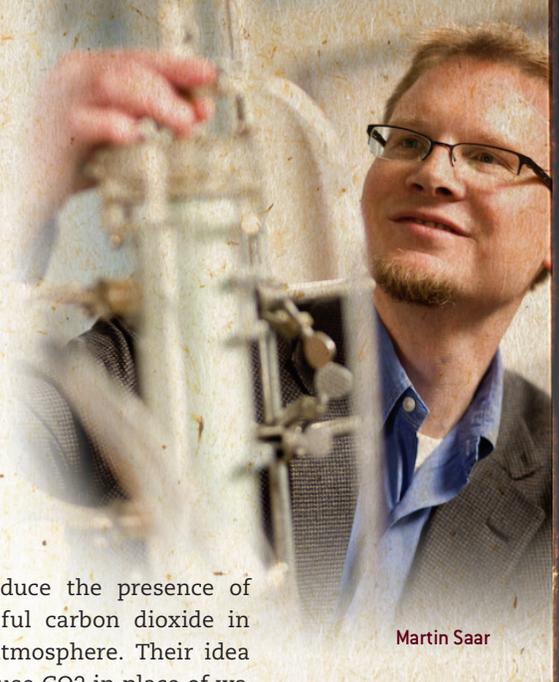
2008 The University opens the Outdoor Stream Lab, a large-scale environmental research facility along the banks of the Mississippi River adjacent to the St. Anthony Falls Lab.

2009 Officials break ground on a \$40 million physics laboratory in northern Minnesota near Ash River that will be led by the University's School of Physics and Astronomy.

2009 The college's Center for the Development of Technology Leadership changes its name to the Technological Leadership Institute.



Paige Novak and Mark Lundgren



Martin Saar

In his research, **DAVID ODDE**, biomedical engineering professor, focuses on understanding how cancer cells migrate throughout the brain. Someday it may be possible to develop a device that would manipulate the mechanical environment of brain tissue to induce cancer cells to take a one-way trip to no-exit eradication.

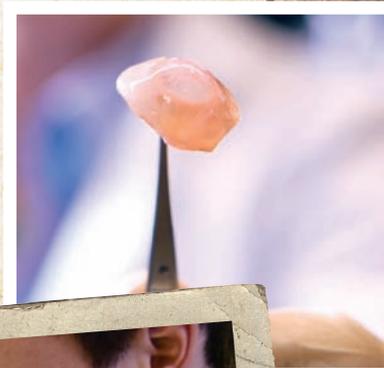


David Odde

to reduce the presence of harmful carbon dioxide in the atmosphere. Their idea is to use CO₂ in place of water in the production of geothermal energy.

PAIGE NOVAK, associate professor of civil engineering, and graduate student

Mark Lundgren have discovered that certain industries may be a significant source of plant-based estrogens, called phytoestrogens, in surface water. ■



MARTIN SAAR, professor of earth sciences, with graduate student, Jimmy Randolph, have devised an ingenious “two-for-one” strategy to simultaneously produce renewable energy and



College of Science and Engineering graduates



Mechanical engineering students

2010 The Electrical Engineering and Computer Science Building is renamed Kenneth H. Keller Hall in honor of the former University president and chemical engineering professor.

2010 The college changes its name from the Institute of Technology to the College of Science and Engineering on July 1.

2010 The college celebrates its 75th anniversary.



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THERE'S MORE TO LEARN...

College of Science and Engineering: The Institute of Technology Years (1935-2010)

For 75 years the Institute of Technology, now the College of Science and Engineering, has pioneered in research, innovation, and technology. Read about the people behind this unique institution in this concise illustrated history, prepared by Thomas J. Misa, professor of electrical and computer engineering and director of the University's Charles Babbage Institute, and Robert W. Seidel, professor of history of science in the Department of Chemical Engineering.

Over a two-year period, the authors researched archives and conducted interviews with 30 present and former faculty, staff, administrators, and students. The end result—which includes more than 120 historical photos and illustrations—is a collective historical narrative that explains the college's origin, development, and contributions to the University of Minnesota, the state of Minnesota, and the world.

To receive your own copy, visit lulu.com, amazon.com or BN.com and enter "College of Science and Engineering misa seidel" in the search bar.

Available in hard cover for \$28, and paperback for \$11.

