Within Our Grasp...

Micro/Nano Technology Is Making Strides Toward Biomedical Applications

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As we prepare to celebrate the graduation of the Class of 2004, we also reflect on the education they received to prepare them for the next chapter of their lives and, in the same breath, consider what we can do better in preparing the new generation of engineers. The debate continues on the means of preparing them for life-long learning, for their studies represent the first four of 40-plus years of education. A new debate has emerged in recent years on what body of knowledge an engineer should possess in a particular discipline. These two issues—how to instill a desire to learn and what the studies while in school should emphasize—also received comments from Albert Einstein in a message to the Progressive Education Association in 1934: “I want to oppose the idea that the school has to teach directly that special knowledge and those accomplishments which one has to use later directly in life. The demands of life are much too manifold to let such a specialized training in school appear possible. Apart from that, it seems to me, moreover, objectionable to treat the individual like a dead tool.”

While Einstein refers to educating young minds in general terms, his following comments closely represent many of today’s discussions on engineering education: “The development of general ability for independent thinking and judgment should always be placed foremost, not the acquisition of special knowledge. If a person masters the fundamentals of his subject and has learned to think and work independently, he will surely find his way and besides will better be able to adapt himself to progress and changes than the person whose training principally consists in the acquiring of detailed knowledge.”

Underneath the desire to prepare future engineers to be critical thinkers lies the motivation required to accomplish the goals one sets for herself, as eloquently expressed by Einstein: “Behind every achievement exists the motivation which is at the foundation of it and which in turn is strengthened and nourished by the accomplishment of the undertaking.” Einstein ends his message with a disclaimer that these opinions were “founded upon nothing but his own personal experience, which he has gathered as a student and as a teacher.”

We all have had experiences that included teachers who motivated us, making their subjects our favorite ones. We also have had experiences where the subject matter itself provided a motivation for both the teacher and the student.

This is where a research university such as Carnegie Mellon offers the added value brought by research that motivates students and professors alike. This issue of Carnegie Mech outlines some of the emerging research areas in the Department that represent these new directions and opportunities in mechanical engineering. Many of these research areas address human health, and involve devices and systems that have very small sizes. Student response to these emerging areas has been extraordinary. Both undergraduate and graduate students continue to show interest in the courses and research topics.

As we continue to build on the strong tradition of the education we provide to our students, we should keep in mind the comment by William Butler Yeats that: “Education is not the filling of the pail, but the lighting of a fire.” It is my hope that this fire will continue to burn for our Class of 2004 throughout their long and successful careers as graduates of Carnegie Mech.
**SHELLEY ANNA**

**Nanoscale Fluid Mechanics**

Professor Shelley Anna joined the Department last fall and already is making strides in the area of nanoscale fluid mechanics. Using traditional fluid mechanics and controlling flow at small length scales, Professor Anna’s research produces novel materials with micro- and nanoscale structure. Although the length scale of the microdevice is the biggest difference in this new research, Professor Anna states, “Modeling fluid flow is not different in microfluidic devices; however, adding molecules like polymers and surfactants to the fluid makes the research more complicated.”

Professor Anna anticipates her work in the creation of nanoscale materials will have an impact in three application areas:

- Interfacing chemical and biological sensors with biological tissues
- Removing contaminants from the skin, using nano-emulsions
- Developing technology for “lab on a chip” devices for pharmaceutical drug-discovery applications

Her research currently focuses on creating nano-emulsions, which should generate interest from areas such as the personal care industry or Homeland Security—particularly in pharmaceutical applications of medicinal skin creams, or in combating bioterror agents that act through the skin.

**PHILIP LeDUC**

**Solid Mechanics**

Professor Philip LeDuc’s research uses traditional solid mechanics within the confines of a very nontraditional atmosphere: cells. Think about the human body and all of the “mechanics” associated with it. Blood flows. The heart pumps. Bones provide the mechanical structure. Whereas traditional solid mechanics focuses on large-scale structures such as trusses or bridges, LeDuc uses the concepts of solid mechanics to examine the structures in cells and how mechanics affects biochemistry.

According to LeDuc, most people view cells as “balloons filled with jelly.” This is a misconception that LeDuc hopes to disband. LeDuc explains, “Cells actually have mechanical and structural aspects: the cytoskeleton.”

LeDuc uses the analogy of an amusement park ride to explain this phenomenon. “The cytoskeleton is the internal structure, or the roller coaster track. The motor molecule is the moving mechanism, or the cars of the roller coaster. The motor molecules ‘walk along’ the cytoskeleton to provide an organizational framework for the cell.”

Understanding the structures of cells, and how they react to mechanical changes, becomes an important issue in discovering how diseases occur. LeDuc’s research is science-oriented in that it explores how the body functions in hopes of understanding the causes of disease.

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Several applications of this research include in vitro diagnostics, tissue engineering, and computational biology.

LeDuc’s group is creating devices that could be used as implants to improve diagnostics. For instance, in cells there are aspects of chemistry, scaffolding, and mechanics. The research conducted in the Cellular Biomechanics Lab focuses on the mechanics of the cell, and how it can be used to assist in the diagnosis and treatment of diseases.

Using computational biology through collaboration with colleagues at the University of Pittsburgh Medical Center, LeDuc anticipates “developing a computational framework to look at how cells and molecules interact, for the purpose of improving drugs for disease treatment.”

As a member of the micro/nano technology field, LeDuc states that his fundamental interest is in understanding disease. He hopes to discover the biological aspects that can assist his colleagues in inventing better treatments for diseases such as heart disease, osteoporosis, and cancer.

**METIN SITTI**

**CONTROLS AND ROBOTICS IN ENGINEERING**

Professor Metin Sitti has been in the Department for almost two years, and he is changing the look of controls and robotics in engineering. Still utilizing traditional design and control aspects of mechanical engineering, Sitti has added new physics and micro- and nanoscale engineering expertise to research the field of micro- and nanoscale robotics. Although the mechanisms involved are familiar—actuators, sensors, and controls—the micro/nanoscale design allows for an unlimited number of applications in the real world.

Micro electro-mechanical systems (MEMS) have resulted in fascinating research in the area of miniature robotics. One project being conducted in Sitti’s NanoRobotics Laboratory involves biomimetics—mimicking nature through biologically inspired creations. The gecko, a funny little lizard with sticky feet, has been a tremendous inspiration in Sitti’s world of miniature robotics. Not only can tiny gecko-like robots be used to inspect, maintain, and repair space shuttle equipment, explore Mars, and conduct search and rescue missions, but the “sticky feet” also have inspired a new age of adhesives.

Sitti says, “Unlike Velcro, which requires two manufactured materials, this new adhesive only needs one piece.” He envisions many applications for this new product, including simple applications such as climbing gear, sports equipment, and clothing, as well as uses in much more complicated arenas like the operating room.

There are currently endoscopic micro-capsules being used in the medical field to provide non-evasive inspection of the digestive tract. The patient swallows the capsule, which contains a tiny camera, and, while it travels through the digestive tract, the camera captures numerous images for the doctors to review. The new adhesive could be used to assist the capsule’s progress by stopping it in a particular area of interest the doctor may need to explore.

Professor Sitti envisions a much more amazing usage for these capsules. He plans to produce endoscopic micro-capsule robots. This means the capsule will be steerable and could contain biochemical sensors to detect disease. According to Sitti, “The robotic capsule could contain microscopic treatment tools to conduct biopsies and result in surgery with no cutting.” Sitti adds that this innovative technology could result in “non-evasive inspection and treatment of the digestive tract.” Sitti also foresees future applications for such a device. His work with swimming micro-robotics could produce non-evasive diagnosis and treatment of other pertinent body functions utilizing liquid, such as the urinary tract and possibly even areas of the brain.

**YOED RABIN**

**HEAT AND MASS TRANSFER THEORIES**

Professor Yoed Rabin is one of the more seasoned faculty members in Mechanical Engineering; he has been here for four years, conducting research using traditional heat and mass transfer theories.

Along with colleagues with expertise in physics, biology, and physiology, Rabin adapts heat and mass transfer research in order to produce nano-particles that can be used to distract cells and tissues by elevating temperatures. By developing nano-particles and oscillating them with a magnetic field, heat is generated.

Science already knows that the body reacts to heat. With a high fever, a person can go into shock within just a few hours. By localizing the effects of hyperthermia, the nano-particles can be used to target specific regions such as a cancerous tumor.

Professor Rabin reminds us that the concept of nano-technology is not new, noting, “In the 1960s, work was being conducted in magnetic fluids. Drug delivery was a common method of distributing the nano-technology. Today, we use the term nano-particles. It is the same science. The difference is that today we are using nano-technology to have a micro-effect.”

One of the challenges faced in the development of nano-particles is targeting an exact area. This is being accomplished by partnering with biochemists to use specific molecules to recognize unique markers of the target cells. Rabin explains, “By utilizing nano-particles in conjunction with drug delivery, the target markers can be found,
and the offending cells destroyed. Although it is impossible to heat just one cell, the technology can be used to target a tumor-sized region. Once the targeted area is reached, there are some questions as to the final destination of the nano-particle. Professor Rabin asks, “Does phagocytosis (the body’s cleaning service) remove the nano-particles along with the destroyed cells?” This is something that constitutes further investigation.

Professor Rabin indicates that animal models can be used to collect this data.

How is engineering applied in nano-particle development? Creating animal models and simulating a tumor is one area where engineers can help, with the assistance of physicians. Engineers can also provide data on predicting cell destruction, based on exposure to increased temperature. The development of the right nano-particles and determining the right frequency to excite them, causing the generation of heat, are handled by the physics experts. Professor Sara Majetich in the Department of Physics at Carnegie Mellon is working with Professor Rabin to connect the necessary pieces of technology. Professor Majetich has developed a few nano-particle types that appear to be perfect candidates for thermal treatment of cancer tumors. And Professor Rabin has developed a device and technique to control the temperature and thermal dosage during the thermal treatment of tumors.

It is clear that, with these new developments in technology, engineers need the expertise of other scientists—and these scientists need the engineers. Collaboration is the only way to be successful in the development of biomedical applications.

FRED HIGGS

TRIBOLOGY

Professor Fred Higgs joined our Department this past fall, and he is offering a course in tribology to students in various departments at Carnegie Mellon. Higgs explains, “Traditional solid and fluid mechanics have been utilized to solve problems in the lubrication of commonly used bearings at low to moderate speeds. With the arrival of new technologies, rotating machinery speeds (and consequently, temperatures) have become extreme and, therefore, can no longer function with liquid lubricants.” Nanoscale liquid lubricants also pose problems in sliding interfaces due to stiction issues.

Higgs’ research examines particle flows at multiple length scales. Current research has already determined that powder flows behave similarly to oil flows, as long as a significant shear force is applied. Therefore, researchers can use the same model applied to fluid mechanics to study the flow of powder. As reported in our previous issue, Higgs’ doctoral studies at Rensselaer Polytechnic Institute (RPI) applied micropowders in large-scale turbomachinery as a lubricant, resulting in the commercial development of a novel powder-lubricated journal bearing at Mohawk Innovative Technology, Inc., in Albany, New York.

Although new models and experiments must be developed at the nanoscale level, Higgs anticipates applying similar approaches for using “nanopowders” as lubricants. Applications for this research include the small interfaces in MEMs NEMs (nano electro-mechanical systems) devices and micro-turbines that can reach extremely high rotation speeds.

Higgs also envisions his particle flow research being used in chemical mechanical polishing (CMP), the process used to remove or planarize metallic or barrier layers on integrated circuit manufacturing. According to Higgs, “The process can be adopted as a tool for manufacturing thin-film magnetic heads in data storage systems. Research at CMU’s Data Storage Systems Center (DSSC) has already employed CMP as a tool for developing advanced read/write technology, but there has been almost no mechanical modeling and experimentation in this area. Most CMP work is focused on the much larger semiconductor market.”

Higgs’ work has important implications for biomedical studies as well. Osteolysis, a condition in which wear debris flows from prostheses cause an adverse cellular reaction of the biological tissue, would benefit from Higgs’ research. As athletic competition becomes more rigorous, sports injuries prompt joint replacement in younger individuals. Younger patients no longer wish to be confined to time-consuming therapy regimens to recover from these injuries. Higgs is working to understand how wear debris is transported in these confined sliding contact environments. According to Higgs, “Examining how the wear debris particles migrate will provide us with a mechanism to prevent osteolysis after total joint replacement.”

Higgs is also developing granular flow experiments that simulate the flow of molecular liquid lubricants. He notes, “Since traditional fluid mechanics is inappropriate for modeling these lubricants, we are currently developing cellular automata models that allow us to predict physical phenomena in cases where first-principle approaches are not available. This is frequently the case at the nanoscale level.”
as a Mechanical Engineering alumnus, recently you may have received our annual appeal in the mail. I’d like to share with you a bit about our annual fund, the Mechanical Engineering Development Fund, and provide you with a quick snapshot of one of our annual donors.

Most annual gifts are unrestricted and are generally spent in the fiscal year in which they are given. Quite often, it’s these gifts that help us to serve you. Your donation to the Mechanical Engineering Development Fund helps to defray the costs of educating tomorrow’s leaders and also assists in advancing the frontiers of engineering knowledge in our Department, on our campus, and beyond.

Lauren Blair
Development Coordinator

P.S. You may have noticed that we have combined our alumni news reply card with a pledge envelope for our annual appeal. A gift is not required in order to submit your updates. Please keep your news coming!

A recent Mechanical Engineering Development Fund donor, Phillip Mervis (B.S. 1985), was kind enough to share his thoughts about supporting the Department through the annual fund.

Carnegie Mech: There are so many different reasons that motivate our donors to give. Can you share with us why you choose to give to the Department of Mechanical Engineering?

Phillip Mervis: I have always given to support the teaching, and not necessarily the research. Universities such as Carnegie Mellon have always been able to attract very creative teachers who do phenomenal research that we are all very proud of. However, it was those teachers who could combine their creativity with an outstanding ability to motivate, communicate, and connect with their students that I learned the most from—and with. They are the teachers that students remember. I give to help support those teachers.

CM: At what time in your career did you start giving philanthropically?

PM: I started giving on graduation day and have tried to give every year since, depending on the economy. If you believe in the Department and the University, then I believe that you should support them if you are able. With the education and experience that I absorbed at Carnegie Mellon, I have been able to do just that.

CM: Are there other organizations you currently support?

PM: My wife and I give to causes, programs, and candidates that we believe can bring positive change to the community.

CM: What would you say to fellow alumni who are “on the fence” in terms of financially supporting their alma mater?

PM: To those who may be uncertain about giving, I suggest a trip back to see what positive changes have occurred since they graduated. Giving is a very personal thing. You need to believe that your efforts will make a difference.

CM: Thank you, Phillip. And thank you to all our friends and alumni whose generosity, in terms of both their time and their financial support, has helped our Department to continually reach new heights in engineering education.

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CM: Thank you, Phillip. And thank you to all our friends and alumni whose generosity, in terms of both their time and their financial support, has helped our Department to continually reach new heights in engineering education.
Alumni Updates

Elizabeth W. Dawson reports that her husband, Robert L. Dawson (B.S. 1941), passed away on October 21, 2003. Our sympathies go out to the family.

Alfred H. Ambrose (B.S. 1941) writes to say he is “still living where the space rockets are designed, and some parts made, and all flights controlled. Keeping up with the action keeps one young.”

Ernest M. Sherry (B.S. 1947) has decided that “giving up racketball hasn’t helped my golf score.”


Michael J. Prokopchak (B.S. 1950) lists the following accomplishments: WWII and Korean Wars, 76 missions, 400 flying hours. Combined total of 27 years in US Army Air Corps and USAF; retired in 1965. Worked for Aramco Steel in Butler, PA, from 1938 to 1948, and at NASA Goddard Space Flight Center as Mission Support Manager from 1965 to 1985. He has been a member of St. John the Baptist Catholic Church choir from 1967 to the present; Knights of Columbus from 1978 to the present (Grand Knight in 1980); Washington Slavic chorus from 1998 to the present; Paul Hill Choral with Washington Symphony from 1971 to 1975; a member of ASME for five years; UPS for one year; NAPA Auto Parts for two years; and a Disabled American Veteran from 1965 to the present.

William C. Smith (M.E. 1987) is currently Director of Operations for TRW Automotive in Chihuahua, Mexico. He says, “My experience at Carnegie Mellon prepared me well for what is now a general management job of a group of high-tech automotive products, including air bags and advanced steering wheels.”

Jonathan Pompa (B.S. 1998) says, “I am now in a Ph.D. program at Scripps Institution of Oceanography, working on wave-powered oceanographic instruments.”

Parting Thoughts of Peter Castelli (B.S. 2003)

Carnegie Mellon as a whole, and the Department of Mechanical Engineering specifically, nurture creativity. As Chairman of the Society of Automotive Engineers (SAE) for two-and-a-half years, I was able to experience this firsthand. When I joined the SAE team as a sophomore, we had about five members, and we hadn’t built a car in years. What we did have was an amazing advisor in Professor John Wiss. He was always open to our ideas and encouraged us, even when the odds were completely stacked against us.

I had some pretty crazy ideas, most of which didn’t work, but I learned. And those ideas that did work seemed to flourish, sometimes beyond our control. At other schools, I would have been told my ideas were too risky, or naive. And who was I to lead a Formula Team? I was just a sophomore, and most SAE team captains are elected seniors. Professor Wiss realized that this was a strength we could use to establish a strong reputation.

Building a reputation is about earning respect. Professor Wiss teaches earning someone’s respect as a two-step process. First, present a “good pitch” to receptive ears to gain support. Second, back it up with strong action to establish respect. While successful actions are inherently better than failed actions, never forget that a failure is far better than not trying.

Building an SAE Formula car costs money, lots of money—about $25,000. That doesn’t include the logistics like travel, shop equipment, and PR. When I started in 2000, all the top engineering schools had Formula cars, except Carnegie Mellon. As if the engineering and logistical challenges weren’t enough, I wanted to build a car entirely from corporate donations. After all, we were future engineers, so why wouldn’t prospective employers encourage unique training and entice us while we were learning? So I contacted people out of the blue, and begged, and begged, and sometimes...it worked. Ford was first to jump onboard, then Target Ganassi Racing and Delphi. Before long, PPG, Alcoa, General Motors, and Daimler Chrysler were on the growing list of supporters.

In the end, all this didn’t happen just through dumb luck. That is why that Hamer-schlag basement has seen more blood and sweat than most battlefields. Those five original team members gave up everything we had for that car, but we all agree it was worth it. The SAE has grown to about 30 full-time members, but they can still be found in the SAE garage, working 24/7 just for the opportunity to try and see if their ideas will work. •
Annual Design Tournament

Another successful design project and tournament for the Introduction to Mechanical Engineering (24-101) course was held in the Fall 2003 semester. This year’s challenge was to build a car powered only by elastic energy, with mousetraps and rubber bands, steered through an L-shaped course.

The cars were required to use only two mousetraps and up to eight rubber bands for propulsion. For steering, two main approaches were used. One approach was active steering, where some cars sensed the beginning of the turn and responded accordingly. However, only a handful of cars used this approach. Among those, one used an optical sensor and servomotor (AAA batteries provided the power); one used unwinding strings to pull a lock, releasing some rubber bands to steer the front axle; and others used the forward movement of the mousetrap to push a rod and steer the axle. The rest of the cars used the second approach: a fixed, circular trajectory to negotiate the track. They had to be carefully aimed at the beginning and would cover the distance without changing their steering; in this case, the front wheels were tilted to allow them to travel in a continuous turn. The first- and second-place winners used the second approach.

MERCK FELLOWSHIP AWARD

Kathleen Puskar, a Ph.D. candidate, has been awarded a Merck Fellowship for the 2003 academic year. It is interesting to note that this is an unusual award, because the Merck Fellowship is a Computational Biology and Chemistry fellowship. Ms. Puskar’s work with Professor Philip LeDuc in cellular and molecular mechanics has sparked interest outside the realm of mechanical engineering.

BOEING SCHOLARSHIP RECIPIENT

Crystal Yeldell is one of a select few who received the Boeing Scholarship this year. This scholarship is awarded to especially promising students in the field of engineering. Recipients of this scholarship exhibit attributes of student initiative and leadership, teamwork, academic excellence and quality, and perseverance. In addition to these outstanding qualities, Ms. Yeldell was also active in the Carnegie Mellon community, as a member of Pi Tau Sigma and as the Spirit Buggy Chair.
A recent collaboration between Carnegie Mellon and Kennametal Co. of Latrobe, Pennsylvania, proved to be a very successful endeavor. Kennametal, the world’s second-largest tool manufacturer, gave Carnegie Mellon a gift grant to cover transportation and building costs—and charged an undergraduate Mechanical Engineering Design class with the task of developing products with socially relevant, environmentally conscious themes.

Under the instruction of Professor Jonathan Cagan, the design course students, working in groups of four, and collaborating closely with Kennametal engineers throughout the semester, developed a number of innovative products. One such product, the Insta-Insert, replaces worn parts in machining tools mechanically. Until now, these multi-insert cutting heads had been replaced manually, causing a 30- to 40-minute downtime in production. With the new Insta-Insert device, Kennametal expects to save at least $60 in every production shift.

This is the first time that Kennametal has patented a product from an undergraduate-level class.

Paul Prichard, Staff Engineer in Kennametal’s Breakthrough Technology Group, told the Pittsburgh Post-Gazette, “Getting a patent wasn’t the focus of this. That was a cool outcome.”

There were 12 teams in the Senior Design Projects class. The team that designed the Insta-Insert device included John Bellinger, Nathaniel Goldblatt, Rachel Lin, and James Raskob. Other products produced in this class included a machinist’s apron to protect workers from stinging lubricant and flying chips, as well as a chiller to keep unhealthy bacteria out of the machine lubricant.

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PROFESSOR PHILIP LEDUC

Professor Philip LeDuc received an NSF Career Award for his project entitled, “Understanding Cellular and Molecular Mechanics with Nano/Micro Technology.” The award is for $396,000, and the funds will assist Professor LeDuc in his research endeavors with mechanics at the cellular and molecular level. Read more about LeDuc’s work in the feature article of this edition, which begins on page 3.

PROFESSOR PAUL STEIF

Professor Paul Steif was selected as the 2003-04 recipient of the Benjamin Richard Teare Award from the College of Engineering. This award is given to a faculty member within the Carnegie Institute of Technology to recognize excellence in engineering education. It was presented to Professor Steif at the CIT Banquet on February 21, 2004.

PROFESSOR WILLIAM MESSNER

Professor William Messner has been elected to be a Fellow in the American Society of Mechanical Engineers International. The “Fellow” grade recognizes significant engineering achievements and contributions to the engineering profession.

PROFESSOR JONATHAN CAGAN

Carnegie Mellon’s Integrated Product Development course received the 2003 American Society of Mechanical Engineers Curriculum Innovation Award on November 18 in Washington, D.C. The course is taught by an interdisciplinary team of faculty, including Professor Jonathan Cagan of MechE; Craig Vogel, Professor of Design; and Laurie Weingart, Professor of Organizational Behavior and Theory.

ASME presents the Curriculum Innovation Award to the course that:

• Demonstrates a significant advancement in engineering education
• Has the potential for significant impact on meeting the changing needs of the profession
• Has the ability to be adapted by many schools in an affordable and effective manner, and shows a likelihood of being widely adopted

The development of this curriculum has led to the start of a collaborative degree program—Master’s of Product Development—between the Department of Mechanical Engineering and the School of Design, with a number of courses being offered in the Tepper School of Business. More information about this new degree program, started in Fall 2003, can be found online (http://www.mpd.cmu.edu).

IN MEMORIAM

Dwight Maylon Billy Baumann

It is with great sadness that we announce the passing of Dwight Baumann, Professor of Engineering Design in the Department of Mechanical Engineering, on September 30, 2003.

Dwight was affectionately known as “Professor” to family and friends. More than a title, the term Professor offered insight into Dwight’s passion for education. As much as Dwight enjoyed the excitement of teaching his students he also relished learning. His thirst for knowledge led Dwight down various paths, including his lengthy endeavors with tort reform law and the use of sunflower oil as an alternative fuel.

Professor Baumann received his doctoral degree from the Massachusetts Institute of Technology, with a minor in Electrical Engineering, in 1960 and has been with Carnegie Mellon for 34 years.

Baumann had been involved in many facets of entrepreneurship, including his position as Executive Director and Founder of the Center for Entrepreneurial Development, Inc. (CED), a nonprofit teaching laboratory and industrial experiment station affiliated with Carnegie Mellon since 1971.

More recently, he was presented with an honorary Doctorate of Laws Degree from the University of North Dakota on May 14, 2000, in recognition of his work in the creation of tort reform law for small-aircraft manufacturers. Baumann was also inducted into the North Dakota Entrepreneur Hall of Fame in January of the same year for his accomplishments as an engineer and as a pioneer in the developing academic field of entrepreneurship.

Baumann leaves behind a wife, Mayvis; two daughters, Susan Wittrock (and husband Gary) and Sandra; a son, Stephen (and wife Lisa); and two grandsons, Jacob and Jonah Wittrock. Other survivors include his parents, William and Alma Baumann of North Dakota, and two sisters, Judith and Maxine.
Cryosurgery is the destruction of undesired biological tissues by freezing. Cryosurgery can be performed as a minimally invasive procedure by inserting a dozen or more miniature cryoprobes, each in the shape of a long hypodermic needle. Currently, the process of selecting the best placement of the cryoprobes for a specific procedure is an art held by the cryosurgeon, based on the surgeon’s own experience.

Professor Yoed Rabin has recently received an NIH award for $720,000 over the next four years for a project involving the development of computerized planning tools for cryosurgery. The main goal in this project is to develop tools that will advise the cryosurgeon about the optimal number of cryoprobes and their locations, in order to improve the outcome of the cryo procedure.

The research also will be used to provide a computerized training tool for cryosurgeons. Collaborators on this project are Professor Kenji Shimada (MechE) and Ralph Miller, M.D., Division of Urology, Allegheny General Hospital.

RedZone Robotics, Inc., a local manufacturer based in the Homestead area of the city, has developed a collaboration with Professor Jonathan Cagan (MechE) and Professor Craig Vogel (School of Design) for their insight into the product development process.

Eric Close, CEO of RedZone, contacted Professors Cagan and Vogel to assist RedZone in the manufacturing process by integrating design, engineering, marketing, and manufacturing into product development. After recent financial difficulties, Mr. Close purchased the company and is re-focusing it.

RedZone Robotics has expanded its market from developing one-of-a-kind robots for dangerous situations, such as cleaning up hazardous waste, to creating robots for inspection and rehabilitation of sewer and water pipes and tanks.

Mr. Close, an alum of CMU’s Business School and former student of the Integrated Product Development course, is confident that, by integrating the product design and manufacturing processes, RedZone Robotics will be a strong and innovative force in this market.

During spring break, Professor Howie Choset’s research group had the opportunity to take its newly designed, weather-proofed robot out in the field to see how it would hold up. Choset and team members Elie Shammas, Mike Schwerin, Jason Geist, and Dan Braido tested the system in two different demanding scenarios while visiting the New Jersey Task Force I. The robot was deployed in both indoor and outdoor search and rescue training areas, and had to contend with harsh conditions, such as wet snow and rain, while outside.

According to Choset, “Not only did the robot perform well and survive the harsh environment, but the team also gained experience in real-world deployment and found inspiration for further improvements.”

Proprietary minimally invasive cryoprobes are shown in comparison with a standard biopsy needle.