From brainstorm to breakthrough

Fanning the flames of innovation
Innovation. It starts with a single thought, question or spark of imagination but, with creativity and perseverance, we move forward and our quality of life improves.

At Binghamton, researchers are fanning the flames of innovation in a variety of fields, helping us broaden our understanding of the human condition, providing direct and immediate applications for industry and searching out solutions to medical conundrums.

This research affects all of us, at the national and state levels as well as in our own communities. Whether working on new computing technologies in facial recognition, new ways to stimulate muscles to help stave off diabetes or new ways to manufacture flexible electronics that will revolutionize our world – Binghamton researchers are making breakthroughs that were unimaginable a few short years ago.

Many of these breakthroughs would not happen without collaboration across disciplines or funding from sources such as the National Science Foundation and the U.S. Display Consortium. Our efforts to strengthen such interdisciplinary research and garner funding will continue as we build on our successes.

We are proud to share these successes with our colleagues, friends and supporters. We believe you will find them as exciting as we do.

Lois B. DeFleur
President

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Fanning the flames of innovation

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The link between research and innovation is as inextricable as that between an engine and its fuel, and for much the same reason. Without innovation, research would go nowhere. Whether in the form of new questions and approaches to discovery, new perspectives on data collection and analysis, or new applications of and techniques for employing knowledge, research is driven and renewed by innovation – the introduction of that which is new.

In today’s competitive research environment, innovation is especially necessary and valued, and not just within the confines of traditional disciplines. New interdisciplinary collaborations spawn and inform innovative new perspectives and are the current trend across the country and around the world.

At Binghamton University, we are justifiably proud that our researchers are on the leading edge of that wave. Supported by our organized research centers and centers for advanced study, which foster and nourish unique interdisciplinary approaches such as those featured in this publication, Binghamton University researchers are among the most innovative in the world.

After reading this issue of Binghamton Research, we think you’ll agree that at Binghamton University the well of innovation remains vital. As a result, our important research is on the move – headed for exciting new discoveries that promise to enhance our regional economy and enrich our daily lives.

Gerald Sonnenfeld
Vice President for Research

To stay in touch with Binghamton research throughout the year, subscribe to our online newsletter, Discover-e, at research.binghamton.edu/discover-e.
Binghamton wins spirited competition to establish center

Following a national competition, Binghamton University has established the Center for Advanced Microelectronics Manufacturing (CAMM), housed at Endicott Interconnect Technologies in Endicott, N.Y., with the support of $10 million in equipment and funding from the U.S. Display Consortium. The center is a collaborative effort among Binghamton, the USDC and other academic, government and industry partners.

The center will help speed microelectronics manufacturing research and development in a roll-to-roll (R2R) — continuous web — format to produce components more efficiently, at higher yields and at a lower cost than is common today.

"Binghamton University developed a very compelling story that draws on the resources of the University," said Michael Ciesinski, USDC president and CEO. "There was creativity in the University's proposal."

The CAMM will evaluate equipment and materials, developed under the auspices of USDC, industry or USDC’s own research and development program, that can be further developed for manufacturing purposes.

Binghamton University will recruit, integrate and manage academic, government and industry participation while creating, launching and maintaining the technical R&D program at the center. Cornell University and Endicott Interconnect Technologies will assist and private companies will participate through paid membership fees and funded research programs.

The CAMM will also work in tandem with the U.S. Army-funded Flexible Display Center at Arizona State University (Tempe, Ariz.) on display-related R&D.

New York State Empire Clinical Research Investigator Project (ECRIP) will fund the study, which is being conducted in collaboration with Dr. James Jewell of United Health Services and the UHS medical education department.

Hypertension diagnoses can be difficult, according to James, because patients are often anxious or conditioned to seeing a doctor’s white coat, making their blood pressure readings unreliable — “white coat” syndrome.

Using ambulatory blood-pressure monitors, James will follow approximately 200 patients who will log their readings for 24-hour periods. The results will then be correlated with their physical activities and emotions. Once the study is completed, James hopes that ambulatory blood-pressure monitoring will become routine medical practice and result in better overall health care.

Study looks at hypertension’s “white coat” syndrome

Gary James, director of the Institute for Primary and Preventive Health Care and Decker School of Nursing professor, is studying ways to improve the diagnosis of hypertension — the leading cause of heart disease, kidney failure and stroke. A two-year, $120,000 grant from the New York State Empire Clinical Research Investigator Project (ECRIP) will fund the study, which is being conducted in collaboration with Dr. James Jewell of United Health Services and the UHS medical education department.

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Division of Research moves to Innovative Technologies Complex

Just one year after the Department of Bioengineering became the first occupant of Binghamton University’s Innovative Technologies Complex, the Division of Research has made the same move into its newly renovated home.

The building also includes lab space, an area for clinical testing and an incubator for new companies using ITC research. Researchers based in the facility will conduct research with the potential for economic viability, becoming a driving force for academic and economic development in the region, said Gerald Sonnenfeld, vice president for research. “It is not a replacement for the research facilities on the main campus,” he said. “The labs are going to be occupied by researchers who are extramurally funded.”

The ITC incubator will serve as a feeder for other incubators in the area, driving academic and economic development. The modular fixtures used in the lab will facilitate modifications made to meet changing research needs.

Renovation of the building is being funded by a $15 million Gen*NY*sis — Generating Employment through New York State Science — grant obtained by State Sen. Thomas Libous.
Bed-rest study investigates female immune response in space

A bed-rest study of women is helping scientists understand changes to immune responses and decreased resistance to infection in space. Gerald Sonnenfeld, vice president for research, is an investigator for the National Space Biomedical Research Institute (NSBRI) study called Women International Space Simulation for Exploration (WISE).

Working with the French Institute for Space Medicine and Physiology, Sonnenfeld will follow healthy, non-smoking female volunteers between the ages of 25 and 40 for 60 days as they are assigned to one of three groups: bed rest, bed rest with a series of exercises targeting the lower body or bed rest with a nutritional supplement. Participants lie with their heads tilted six degrees below horizontal so their feet are elevated higher than their heads.

Researchers will collect physiological data to serve as a baseline, then again at specified intervals during the study. Participants will be monitored for up to three years to see how their bodies recover.

WISE is a collaborative venture that includes NASA, the European Space Agency, the Centre National D’Études Spatiales and the Canadian Space Agency. Sonnenfeld’s team includes Janet Butel of Baylor College of Medicine, William Shearer of Texas Children’s Hospital and Baylor College of Medicine, David Niesel of the University of Texas Medical Branch at Galveston and Michel Abbal and Antoine Blancher of the Université Paul Sabatier in Toulouse, France.

KUDOS

• Dawnie Steadman, assistant professor of anthropology, recently earned certification as a Diplomate of the American Board of Forensic Anthropology. The certification is the highest accreditation available in the field of forensic anthropology. Fewer than 75 people have obtained the certification since the program began in 1977, and Steadman is one of only 60 people nationwide who currently hold the credential.

Forensic anthropology is the application of the principles of skeletal biology and archaeology to the identification of skeletal, fragmentary, decomposed and incomplete human remains.

• Jessica Fridrich’s reliable technique for detecting steganography — messages hidden in digital pictures and other computer files — and Ronald Miles’ work to create microphones based on the ear of a fly are among a number of innovative patents recently issued to the Research Foundation of the State University of New York. Fridrich is an associate professor in electrical and computer engineering and expert in steganography and steganalysis. Miles is a professor of mechanical engineering.

Fridrich’s detection method and system involves using steganalysis — performing statistical analysis on the file in question — to detect the presence of embedded information. The technique finds the attempt at secret communication and also indicates the size of the information that is hidden. The invention, by Fridrich and Miroslav Goljan, research scientist of electrical and computer engineering, was made with support from the U.S. Air Force.

Miles has based his tiny microphone on the ears of the Ormia ochracea, a small parasitic fly that uses sound to track down its hosts, even in the dark. His work could lead to tinier hearing aids that gather sound from the direction the wearer is facing, as well as to noise-canceling microphones, battlefield surveillance devices and smaller, more efficient telecommunications devices.

Miles’ collaborators are Sanjay Sundermurthy of Starkey Laboratories; Colum Gibbons of Northrup Grumman; Ronald How, professor of neurobiology and behavior at Cornell University; and Daniel Robert, professor of biological sciences at the University of Bristol, United Kingdom.

• Two Binghamton anthropology professors shared the spotlight in April, receiving the Franz Boas Distinguished Achievement Award from the Human Biology Association, after playing instrumental roles in establishing the award in 1994. Michael Little, distinguished professor of anthropology, and Ralph Garruto, research professor of anthropology and neurosciences, were presented with the Boas award for their achievements in the field of human biology during the association’s 30th annual meeting.

Many hold Boas as the father of American anthropology through his involvement in “big science” — larger projects involved in the understanding of human variation among different groups in the United States.

• George Klir, distinguished professor of systems science and industrial engineering, and Timothy Perry, professor of music, were recognized with the Research and Scholarship Award by the Research Foundation of the State University of New York. The award, the highest the Research Foundation can bestow, is given annually for outstanding scholarly and research contributions in the humanities, arts, social sciences, sciences, medicine and engineering.

Klir has done path-breaking research in the domain of general systems theory, generalized information theory and in the area of fuzzy sets and fuzzy logic. Perry demonstrates the highest level of creativity in his work as performer, conductor, composer, researcher and educator.
BIBLIO TECH:

BU libraries streamline access to better support research and scholarship.
The prestige of a research library used to rest on the materials it owned — its millions of volumes, its original manuscripts, its rare books. In the digital age, however, researchers judge a library on other criteria as well, said John M. Meador Jr., director of the Binghamton University Libraries.

Now, it’s ‘What can we provide access to?’” Meador said. Though, to some extent, providing access still means building collections, it also means subscribing to electronic publications and databases and developing efficient ways to share resources with other libraries.

Binghamton’s libraries — the Glenn G. Bartle Library and the Science Library — own more than 2.3 million volumes plus hundreds of thousands of other items, such as CD-ROMs, government documents, microforms, sound recordings and maps. The library system continues to vie with other institutions for unique materials to enrich its special collections. At the same time, Meador said, the University’s libraries are cooperating to make information available more easily. “There is more collaboration among research libraries than ever, as we try to share existing print resources and find ways to capture digital resources,” he said.

In particular, the University libraries are increasing their collaboration with other libraries in the State University of New York system, Meador said. “For example, we have a courier service now among all SUNY libraries that allows us to get a book for you within a couple of days.” With this service crisscrossing the state, SUNY librarians have started to discuss whether they all need to buy the same books. Perhaps, instead, each should concentrate on certain aspects of a discipline, relying on their collective resources to cover the entire field, he said.

SUNY’s libraries have all used the same software to develop their electronic catalogs. Now continued on page 8
At less than 60 years old, the Binghamton University Libraries have not had the chance to assemble the troves of old books and manuscripts found at institutions with much longer histories, said Jeanne Eichelberger, head of special collections, University archives and preservation. But through fortuitous gifts and acquisitions, the libraries have enriched their special collections with some exceptional treasures.

Several collections focus on local industrial history, and one of the highlights is the Link Collection. This comprises the papers of Edwin A. Link, a Binghamton-based inventor, industrialist and pioneer in flight simulation; his wife Marion Clayton Link, a journalist and underwater explorer; the Link Foundation; and Link Aviation/Hughes Training. In an unusual move, when the Link family donated this collection, “they gave it to us with the specification that they were also giving us the copyright,” Eichelberger said. This means the libraries can permit scholars to quote from or reproduce materials from the Link Collection without first consulting the family.

The Max Reinhardt Archives collect material on Austrian-born director and producer Max Reinhardt and other major figures of 20th-century world theater. “We have a lot of original scene and costume designs,” many of them created by prominent artists, Eichelberger said. “We have a lot of his correspondence, programs of his productions and his prompt books, which are the books in which he made notes while he was directing.” The collection also includes several thousand books from Reinhardt’s personal collection.

The Frances R. Conole Archive of Recorded Sound contains more than 50,000 records and tapes, with special emphasis on opera singers from 1900 to 1960. Librarians are currently cataloging these items. To help preserve the collection, the libraries recently purchased a preservation device that converts recordings on vinyl to CD format, so researchers can listen without danger of damaging fragile disks. “Nothing ever touches the record; it’s all laser,” said John Meador Jr., director of the Binghamton University Libraries. “You can literally take a record that’s in pieces and piece it back together, and it will play it. As it plays it, it digitizes it.”

The William J. Haggerty Collection of French Colonial History contains about 25,000 volumes that were produced in or focus on French and British colonies during the 19th and 20th centuries. “It’s fascinating from the standpoint of sociology, anthropology and history of the colonial areas — mainly Africa and Asia, but some in South America as well,” Eichelberger said. “We have the largest Arabic collection within the SUNY system.”

Meador pointed out. The libraries also have a significant Hebrew/Judaic collection and, as part of that, a Holocaust collection, he said.

For the future, library officials have set their sights on collecting creative works by former Binghamton students. “We have wonderful, creative alumni, and they’re starting to get to the age where we can approach them about their papers,” Meador said. “That’s one of our goals, to continue to attract significant primary research materials or special collections, to give us a distinction among research libraries.”
“There is more collaboration among research libraries than ever, as we try to share existing print resources and find ways to capture digital resources.”

John M. Meador Jr.
Director of the Binghamton University Libraries
they’re working toward a unified catalog system, which would let researchers find materials housed on any SUNY campus with a single search, said Frank Mols, the Binghamton libraries’ associate director for technical services and budget.

Also, “we’re discussing a way that all of SUNY can participate in a digital repository for materials being generated now on campus that were ‘born’ digital,” Meador said. These include all student dissertations and a great deal of faculty research. “We’re trying to figure a way for libraries to help faculty and students by storing and cataloging digital information the way we have historically done with print.”

Making this material, from campuses across New York, instantly available online, he said.

The emergence of electronic journals has also spurred opportunities to collaborate, and it has helped make information more accessible to researchers at the University. A five-year agreement now in place between the SUNY system and Elsevier Press gives students and faculty at all SUNY campuses online access to Elsevier’s 1,800 science and technology journals through the publisher’s ScienceDirect service. Leveraging the buying power of the state university system reduces Binghamton’s costs, and it allows the Binghamton libraries to offer titles they stopped acquiring in print in the early 1990s due to budget constraints.

When those titles reappeared as part of the package, that came as good news for scholars at Binghamton, Mols said. “People needed those things and did without them for a few years. Now they’ve come back electronically, and the usage statistics are there to support that we should have had them.”

Publishers of science and technology journals have embraced electronic publishing sooner than their counterparts in the humanities and the arts, Meador said. “But it’s a no-brainer that eventually every journal will become digitally available, exclusively, and if you want a print copy, you’ll probably have to print it yourself.” Libraries will no longer have to bind journals or make shelf space for them, and researchers won’t have to wait months for publishers to print and mail the latest issues, he said.

Today, though, a library is still a paper-intensive enterprise. The more Binghamton’s collections grow, the more creative library officials must become about managing their physical assets. In 1999, the libraries opened the Library Annex at Conklin in a converted warehouse 10 miles east of the main campus. This facility houses about 300,000 volumes, mostly bound journals published before 1980 and selected monographs that are not often used.

The libraries moved these materials off campus because “we were out of shelf space,” Mols said. “To create space to put up more stacks meant taking seating away, and there’s only so much you can do of that and still provide an effective study area.”

“We have many volumes out there, but the key is, they’re accessible,” said Caryl Ward, the libraries’ head of acquisitions. When a user requests a volume from the annex, “we send a courier out, he comes back and the book is available at the reference desk,” generally within 24 hours, she said.

Among faculty, the biggest complaint about off-campus storage is that “they can’t browse the shelves and see what else is there because they don’t know what’s in storage,” Meador said.
“That’s why we’ve started to staff that facility, which is now open to researchers.”

The libraries could offer another solution soon. “If somebody wants a journal article that’s in storage, I want to set it up so that it’s digitized out there at the storage facility and e-mailed to the faculty member, so you don’t have to move paper into campus,” Meador said.

Such a system would be in keeping with a general trend that Meador said he has observed: “a shift in libraries toward the user of the materials being empowered.” Libraries have evolved a great deal since the days of closed stacks, he said. Back then, when a patron needed a book, he or she used a slip of paper to request it and a runner retrieved it.

Even when electronic databases emerged, researchers didn’t search them on their own, Mols said. “It used to be that every search was a mediated search. The faculty member had to come in and sit with the librarian to search Dialog or another database. And what they paid in connect time was outrageous.”

Now, users locate books themselves and may also check them out on self-service machines; they request interlibrary loans online; they search electronic databases and read electronic journals; they receive articles via e-mail. Today, “librarians are facilitating the self-help of users,” Meador said.

Nevertheless, “one of our most valuable resources, which has been cited in some of our surveys, is being able to come in and work with a librarian one on one,” Mols said. Subject area specialists at the Binghamton University Libraries work closely with faculty researchers, sometimes even co-teaching courses with them, he said. Despite the trend toward greater autonomy in research, the option of personal contact “is still there and still valued.”

New subscriptions offer better view of Neolithic artifacts

Iran’s 1979 revolution brought archaeological research in that country to a halt. Only in the past five years have Iran’s leaders started to make their sites available again for study. Reinhard Bernbeck, professor of anthropology at Binghamton University, is one of the archaeologists now focusing on prehistoric civilizations in Iran. For him, access through the Binghamton University Libraries to both pre-1979 scholarship and the most recent studies is essential.

Working with Binghamton anthropology professor Susan Pollock and Kamyar Abdi, assistant professor of anthropology at Dartmouth College, Bernbeck has been excavating a site from the late 7th millennium B.C. at Toll-e Bashi, Iran. The team’s goal is to better understand how the people of that region made the gradual transition from hunting and gathering to agriculture and herding. A $20,000 grant from the National Geographic Society helps support the project.

As Bernbeck and his colleagues unearth house walls, bits of painted pottery, stone instruments and other artifacts, they must compare them to similar items found by other researchers. Often, they rely on photographs in journals to make the comparisons. The better the quality of the reproduction, the more information they can derive.

They might, for example, try to compare a tool found at their site with tools found elsewhere.

“If the photographs aren’t very clear, you are not going to see any of the details that are necessary to identify both how old they are and what they were used for,” Bernbeck said.

Bernbeck has been working with the Binghamton University Libraries to subscribe to new journals that focus on archaeology in Iran so he can see the photos in their original published form. When he orders articles through interlibrary loan, he often receives photocopies whose poor quality “can pose real problems,” he said.

“I was able to add a significant number of specialized journals to the collection of the library, at least through the next few years,” Bernbeck said. These journals are not published electronically, either because their publishers lack the technical savvy or because the journals appeal to too small an audience to justify the effort, he said.

Bernbeck used to visit Cornell University for some of the periodicals he needed, but the new subscriptions reduced his need to travel. Now, “there are some things we have here that Cornell does not have,” he added.

For pre-1979 scholarship, Bernbeck orders journals from the libraries’ off-campus facility, the Library Annex at Conklin. He also uses non-periodical materials the library has acquired more recently. “I’m pretty happy at the moment with what we’ve bought in terms of monographs,” he said.
With funding from Binghamton University’s Integrated Electronics Engineering Center (IEEC), Jiayuan Fang developed and patented software that can provide electromagnetic analysis of integrated circuits from chip to package to board, assessing overall power and signal performance. An associate professor of electrical engineering at the Thomas J. Watson School of Engineering and Applied Science at the time, Fang created a company – Sigrity – to help customers overcome design challenges due to ever-increasing circuit speed in the world of integrated circuits, packages and printed circuit boards.

A successful transfer of technology had occurred.

With an ever-increasing role on campuses across the country and around the globe, technology transfer – the movement of new technology from its creator or researcher to a user, especially as a product or publication – can herald good things for schools with strong biomedical or pharmacological research activities. But Binghamton University can also realize successes, like Fang’s.

Fang relocated to Silicon Valley, taking Sigrity with him, yet he still maintains a financial tie to the University because his breakthrough, patented work was conducted with IEEC funding. A portion of the licensing fees for his software technology comes back to the University’s Division of Research and to the IEEC for investment in new projects.

There’s more to the win-win situation for faculty and students involved in technology transfer. The incentive to achieve what Fang did is great because, under the SUNY Patents and Inventions Policy – one of the most generous in the nation – 40 percent of gross royalty income goes to the inventors. The more activity Binghamton sees in research, the higher the probability that there will be other product and company spin-offs to mutually benefit the researcher and the campus – and activity is increasing. Last year, Binghamton faculty filed 20 new technology disclosures and eight patent applications. In addition, two U.S. patents were issued and the University currently offers many more licensing opportunities on technologies developed by its faculty.

“There’s a lot of discussion and debate in higher education as to what all this technology transfer means,” said Stephen Gilje, associate vice president for research. “We’ve been involved in technology transfer for some time. Now, however, we’re focusing the job very much on working with the faculty. It’s also more of a team approach, working with Bahgat Sammakia as executive director of economic development and outreach. These two areas go hand in glove.”

“There’s no question we have to work together,” said Sammakia. “Economic development is much broader than technology transfer, but has a very strong technology transfer element. For economic development, we look at what companies think about and are in need of, how we form teams and get grants to support research of interest to local companies.”

To bring that faculty focus to fruition, the University recently brought Eugene Krentsel on board as director of technology transfer and innovation partnerships. Previously director of the International Technology Commer-
cialization Institute at the University of Missouri-Columbia, Krentsel is a chemical engineer who has been an active researcher and inventor. “I come from the same background, so faculty researchers should see me as a peer, which is a plus,” he said.

The first task he has set for himself is to learn what the faculty do and what their needs are. “All else is secondary until I get a good feel for things,” he said.

“This is a job that is proactive,” he added, “building relationships on the faculty side as well as the company and agency side.”

Krentsel is also on the lookout for opportunities to help create synergy among faculty. “Some projects are specifically technology transfer-related,” he said. “But others are building research opportunities for faculty. There could be opportunities to make interdisciplinary connections. We won’t be telling them what to do. We’ll be bringing opportunities to them so they can make the decisions.

“The main goal is to help them be the best they can be,” he added. “We’re in a partnership with faculty. My role exists for them and is driven by their interests. We can help shape those interests by bringing opportunities to them, but can’t make decisions for them.”

Keeping an eye on the future is also part of Krentsel’s job. “Sometimes you have to go beyond research and try to assess what the market needs will be five years down the road,” he said. “There’s a technology push, but there’s also a market pull, and you need the combination of both for technology transfer to be successful.

“We can help our faculty tailor their research by helping to find out what the market needs and how it can affect what they’re working on.”

Even with a technology transfer focus, the University has no lofty revenue-generating expectations. “This operation should not be looked upon as a profit center,” said Krentsel. “We can’t plan on making millions of dollars next year; it would be not unlike planning your budget based on winning the lottery next month. We want to generate a healthy revenue stream, but it is not going to happen overnight.”

In fact, according to Gilje, the reality of the situation is that a successful technology transfer operation is one that breaks even. “The more successes you have, the more investment,” he said, explaining that there are additional factors to look at in gauging success.

“We’re providing this service to faculty so we can recruit, retain and reward our faculty,” he said. “The most creative faculty require this level of service and it allows us to be able to best manage our intellectual property. We exist to enable faculty to focus their efforts on all aspects of research and scholarship. That’s what we hired them for, not for dealing with technology transfer.”

Krentsel said it all comes back to the University’s mission. “What is the main, core business of a university?” he asked. “To generate knowledge and transmit or disseminate it. Technology transfer is a part of knowledge dissemination, and as such, it becomes a core business.”

David Goldman a model for SPIR success

David Goldman has a lot of irons in the fire these days.

He recently relocated his business to a new building after renovations were completed, and he’s expecting approval for his fifth and sixth patents soon. Goldman is a 1998 graduate of the Thomas J. Watson School of Engineering and Applied Science with a doctorate in computer science. Using software he created called IntelliStitch, his company, Soft Sight, automates the design creation process for the data that is fed into large commercial embroidery equipment.

A model case for the Strategic Partnership for Industrial Resurgence (SPIR), Goldman worked as a SPIR student while attending Binghamton and now utilizes its resources to keep his business strong and growing. “Since he’s been in business he has employed anywhere from two to four SPIR program assistants per semester,” said C. Michael Mercincavage, executive director of SPIR. “He recently cut back from four, which he was fully funding, to three because he just hired another one of our students as a full-time employee.”

“We are continually moving forward,” said Goldman, who formed his company immediately upon graduation. “I could have located the company anywhere, but the University, and particularly SPIR, give me a compelling reason to stay in the area. The University has high-quality students, and programs like SPIR allow small companies to leverage that expertise.”

Goldman appreciates the University’s support of programs like SPIR. “To the businesses that take advantage of these programs, it means a lot,” he said. “It’s a program that supports itself, and it’s easy for me to say we wouldn’t be here if not for the University and SPIR.”
Since the beginning of civilization, salt has been intricately linked to health, wealth and prosperity. Stemming from the Latin *salarium*, the word “salary” quite literally means “salt money.” In Rome, it seems, while soldiers were fed, housed and uniformed by the Empire, the salt they needed to season their otherwise bland rations had to be purchased out of their own daily allowance, or *salarium*.

For geologist Tim Lowenstein, who specializes in the study of fluid inclusions — small pockets of ancient seawater or other fluids that become trapped in ancient salt or rock formations, the worth of salt is intrinsic. In his laboratory, an ordinary salt crystal containing even a microscopic fluid inclusion is transformed into a providential portal, affording extraordinary new perspective on worldwide climate change, new contexts for the history and evolution of ocean-dwelling plants and animals, and new understandings of the changing chemistry of seawater over the past 600 million years.

Since salts are formed by evaporation, salt itself provides “beautiful records of past climates,” Lowenstein said. By analyzing the salts and the ancient seawater that is often found trapped within them, researchers can deduce much about the climatic and evolutionary history of the planet.

“These fluid inclusions are like tiny little time capsules of seawater and, sometimes,” he said, “of life that could have been trapped in it.”

Lowenstein became involved five years ago in the controversy over *Virgibacillus* sp. 2-9-3, a bacterium discovered in 2000 in a fluid inclusion retrieved from a salt bed about a third of a mile beneath the Earth’s surface near Carlsbad, N.M. When scientists at West Chester University in Pennsylvania extracted fluid trapped within the crystal and mixed it with nutrients, the dormant bacterium sprung to life and began growing.

Until discovery of *Virgibacillus* sp. 2-9-3, the title of “oldest known living thing” had belonged to 30-million-year-old yeast cells found trapped in amber. But initial reports suggested *Virgibacillus* sp. 2-9-3 spores revived from within the ancient Carlsbad salt crystal could be more than eight times that old. Using techniques developed by Lowenstein’s research group, researchers set about trying to unravel the mystery. If they were right, *Virgibacillus* sp. 2-9-3 was 250 million years old and would be uncontested as the world’s oldest known life form.

His work could ultimately help push back by hundreds of millions of years the timeline of life on Earth — all of which helps to underscore what his fellow geologists have known for years: Tim Lowenstein’s research is clearly worth its salt.
Along with doctoral student Cindy Satterfield, Lowenstein recently performed tests that concluded that both the salt sample linked to *Virgibacillus* sp. 2-9-3 and the brines from which it was extracted have chemical compositions consistent with Permian ocean water and salt. He welcomes the heated debate over the source and age of the bacterium in scientific communities spanning geology, biology and chemistry because it fuels invaluable scientific inquiry.

“Every new doubt and every new question opens the door to another area of exploration,” Lowenstein said.

For instance, most fluid inclusions trapped in ancient salt are only a fraction of the width of a human hair, so working with them can be difficult. As a result, every analysis of ancient fluids was until recently subject to charges that the samples might have been contaminated during the extraction process. Several years ago that debate stoked the development by Lowenstein’s research group of a chemical analysis technique that is today commonly accepted by geologists as providing scientifically reliable results. The technique involves freezing and slicing open the inclusions before using an electron beam to determine their chemical composition.

Lowenstein and Satterfield’s most recent study addresses a second criticism. Some have argued that the retention of younger fluids as they flow through older rock is not uncommon, meaning that both the fluid inclusion and the bacterium it contained might be naturally occurring younger contaminants of older rock salts. But Satterfield and Lowenstein have now shown that the chemical fingerprint of both the brine inclusion in which the *Virgibacillus* sp. 2-9-3 bacterium was found and the salt crystal itself are consistent with that of Permian seawater, which would date the two at about 250 million years old. The results of their study, which appeared in the April 2005 issue of the journal *Geology*, lend credence to — but stop short of proving — the claim that the revived bacterium is 250 million years old. That will remain controversial until researchers find a way to prove conclusively that the bacterium was not somehow introduced into the quarter-billion-year-old “time capsule” comprising Permian period seawater trapped within a rock salt crystal.

Lowenstein thinks ongoing debate on the nature and age of the bacterium itself is reasonable and warranted. The revived bacterium, which is genetically related to a modern species of *Bacillus* and exhibits a greater than 99-percent DNA match to one modern relative, could still possibly be younger than any of the apparent circumstances of its discovery would suggest, Lowenstein admits.

“It’s definitely not something to be ignored, and we’re working with microbiologists, including Matthew Parker, an associate professor of biological sciences at Binghamton University, to try to identify how we can better establish the age of the bacterium itself,” he said. “In these debates it’s okay to have controversy. With every question, we get a little closer. Eventually, we’ll get to the truth.”

As a next step Lowenstein’s research group is pursuing the development of rubidium-strontium dating that would allow them to establish absolute dates on fluid inclusions in similar samples from the Carlsbad site. Working with a grant from the National Science Foundation, Lowenstein’s group eventually hopes to use the dating techniques to establish unequivocally whether *Virgibacillus* sp. 2-9-3 was trapped in a fluid inclusion at the time of deposition of the Permian salts. That research is being conducted by Lowenstein and Binghamton post-doctoral fellow Michael Timofeeff in collaboration with Oak Ridge National Lab and the University of Tennessee, Knoxville.

If that is proven, it would seem to open up the possibility that life, in the form of bacteria, could originally have been transported to Earth by meteorites, Lowenstein noted. Salt crystals similar to those containing the *Virgibacillus* sp. 2-9-3 bacterium were found in 1999 in a meteorite, he said.
The language of taste:

Neuroscientist seeks to crack the code behind sweet, sour, bitter and salty
Liver. Limburger cheese. Caviar. Chili peppers. Blood pudding. Some things in life are undoubtedly acquired tastes. But for primary taste sensations — sweet, sour, bitter and salty, we don’t need experience at all. Even a newborn can taste the difference between sugar and salt. Still, the brain activity behind the sense of taste is complex, and scientists don’t entirely know how it works.

Patricia DiLorenzo, a professor of psychology at Binghamton University and area coordinator for behavioral neuroscience, thinks the key to how the brain transmits taste information lies in temporal coding — sets of electronic pulses that some cells emit over time in meaningful patterns. Learning how these patterns work could help scientists better understand how the brain transmits information not just on taste, but on all five senses — knowledge that might one day produce new electronic aids that restore hearing to the deaf or vision to the blind.

Temporal coding could also play a role in developing artificial intelligence.

Last spring, DiLorenzo received a five-year, $1.2 million grant from the National Institutes of Health (NIH) to help her crack the code that tells the brain what the tongue is tasting.

The brain recognizes just four or five distinct tastes: sweet, sour, bitter, salty and possibly umami, the taste of monosodium glutamate (MSG). Tastes combine with smells to create the diverse experiences we call flavors, allowing us, for example, to tell a grape lollipop from a cherry one.

When the tongue encounters a taste, the voltage across certain brain-cell membranes jumps for about a millisecond, a response known as firing or producing a spike. Different cells respond to different tastes; most respond to two, three or four. “Over time, a cell will fire many times, and you can record a firing rate,” DiLorenzo said. In the lab, that’s done by implanting an electrode in the brain of a rat, allowing the animal to lick flavored water and capturing the results.

The timing of the spikes is as important as their number. “You might have 10 spikes in a one-second response. But five of them may occur in the first 200 milliseconds, and the other five would be spread out throughout the response.”
the rest,” DiLorenzo said. The spikes and the pauses between them make up a temporal pattern.

Ten years ago, DiLorenzo demonstrated that certain cells respond to different tastes with precise temporal patterns that carry information about the stimulus. By playing back a recorded temporal pattern, one can make a rat react to plain water as though it were laced with sucrose or quinine.

“The initial behavioral experiments demonstrated that the temporal pattern was important and the animals would experience the simulation like a taste,” DiLorenzo said. “But we still didn’t demonstrate that the sucrose simulation pattern was generating a sweet taste — just that it was demonstrating some taste.” Her recent work has addressed that question by conditioning a rat, via lab-induced nausea, to avoid a simulated sweet taste and then seeing if it would also shun natural sucrose.

That’s exactly what happened. The rat “would drink sour or salty, or even bitter at low concentrations” but not a sucrose solution, DiLorenzo said. “It was a specific aversion generalized to sweetness. If we extinguished the aversion to electrical stimulation, (we) also extinguished the aversion to sweetness.”

But what exactly about the temporal pattern carries information that says “sweet” or “bitter”? Tests with quinine, which rats avoid without conditioning, show that the order of the spikes and the spaces between them is crucial. DiLorenzo tried randomly shuffling the spikes and pauses in a quinine response and then playing the resulting pattern into a rat’s brain. “The animal did not avoid it at all. It just completely scrambled the information,” she said.

Yet, the code that spells taste apparently doesn’t depend on every spike and pause in the pattern. Quinine may provoke different temporal responses from different cells, any of which can be played back to simulate that taste. DiLorenzo compared three quinine patterns that were effective in simulation and identified their common features, the spikes that fell at the same points in all three. She then generated a fourth, artificial pattern that contained those spikes in those locations.

“The rats avoid the composite pattern, and they don’t avoid the randomly-shuffled pattern. So we know that the information in the composite pattern is somehow retaining the information from these individual cells,” she said.

As a next step, DiLorenzo will look at the cells that receive electrical impulses from cells that fire, to learn how these targets use information in the temporal code to make an animal react with appropriate behavior.

DiLorenzo collaborates on her work with Jonathan D. Victor, professor of visual neurophysiology at Cornell University’s Weill Medical College in New York, who has developed methods to detect and analyze temporal coding. Another partner, Linda Head, associate professor of electrical and computer engineering at Rowan University in Glassboro, N.J., is developing an “electronic lollipop” that could help test whether electrical pulses can simulate tastes in humans.

If researchers can decode the electronic language of the senses, “this could give us some insight into building better sensory prosthetics,” such as the cochlear implants that today restore partial hearing to people who are deaf, according to DiLorenzo.

Sensory coding could also help researchers develop machines that “think” in a much more sophisticated way than even the supercomputers of today. “The idea that you can produce and read a temporal code adds a richness to encoding or to information transmittal that’s not currently being used,” DiLorenzo said. She cited Henry Markram, a Swiss professor who is working with U.S. researchers at IBM to develop a digital brain. “If he could add a temporal dimension to his code, it would give him another avenue with which to encode information,” she said. “It’s an untapped domain.”
From homeland security to Hollywood:

Computer scientist’s work on facial modeling promises more accurate identification, more lifelike simulation
With his graduate students in Binghamton University’s Graphics and Image Computing Laboratory, Yin is working on facial modeling techniques that could lead to advances in all those areas. The two-year project is supported by a $100,000 grant from the National Science Foundation.

At the heart of the work is technology to convert two-dimensional video images of a face into a high-resolution, three-dimensional computer model. Yin, an assistant professor of computer science in the Thomas J. Watson School of Engineering and Applied Science, uses an ordinary video camera to capture multiple views of a subject’s head. A computer algorithm extracts more than 3,000 pieces of data from each of those images and combines them in a way that describes the person’s features in three dimensions. The system then takes a 3D computer model of a generic head and electronically molds it to match the person’s features. The result is an image of the person that a viewer can rotate through 360 degrees, including views from angles the video camera never captured.

Yin started his work on facial modeling about six years ago while working on his doctorate at the University of Alberta. Initially, the aim was to develop simulations that plastic surgeons could use to plan their work and to show patients how they would look after surgery. “To do this, we have to build a model of a real person and then manipulate it,” he said.

Today, Yin is developing the technology for use in a system that captures the face of a person who walks past a surveillance camera, uses those images to build a 3D model and then quickly compares it to photos in a database of terrorist suspects. The process takes just a few seconds and it gives a much more accurate match than existing systems that rely on only two-
dimensional images, Yin explained. “3D will give you more detailed information and get you closer to the face of the original person’s features.”

So far, in attempts to match the faces it has modeled with photos in a database, the system has achieved 92-percent accuracy. Yin and his team continue to refine the algorithm.

Scanning devices already exist that create a 3D model while slowly rotating around a person’s head. But these are expensive, “and they require the person to cooperate with you,” which means they can’t be used in surveillance, Yin said. “We try to use a different approach. We use regular surveillance video, and no one is aware we’re taking the picture.”

Poor lighting, shifting facial expressions or head poses, changes that occur with age and such variables as beards and eyeglasses all pose obstacles to facial recognition. “No existing system can solve all these problems,” but the 3D high-resolution approach can help mitigate these problems, Yin said. Part of his work focuses on ways to adjust the model to recognize different facial expressions, making it easier, for example, to match a smiling subject in a video with the photo of a scowling face in the database.

Along with recognizing faces and expressions, Yin is exploring ways to generate expressions and transfer them from one face to another. In movies or video games, such techniques would make computer-generated characters appear more lifelike. They could also be used to blur the line between stunt actors and stars. “The real actor can do the expressions. We use a camera to capture their motions, then use this person's motions to duplicate them into another person's expression,” Yin said. When a stunt double takes over during an action sequence, “we can put a virtual face on him, modeled from Tom Cruise.”

Facial models could also provide a new way to conduct videoconferences. Rather than transmit a video image of a conference participant to a colleague at another location, a next-generation system could capture the image, translate it into a computer model and transmit just that model. This requires much less bandwidth than transmitting the video. “We try to use a regular phone line,” rather than a high-speed Internet connection, Yin said.

Actually, Yin explained, “we don’t transmit the model. We share the same model on both sides and transmit only the changes.” If the subject smiles, for example, the system transmits just enough information to adjust the model at the other end, so that the image of the subject — the avatar — changes to mimic the real person's face. “This is a very difficult aspect, using just a few parameters to reconstruct the expression on the other side,” he said.

Expression recognition and generation may prove important in human-computer interaction as well. “A disabled person cannot use the keyboard or mouse, but he can perform expressions,” Yin said. Captured by a camera and translated into code, those expressions could be used to give commands to a computer.

“We want to build a system that allows you to interact with a computer just as you would interact with a human,” said Yin, who has been talking with several members of Binghamton’s psychology department about the connections between expression and feelings. Ultimately, he says, “we want the computer to recognize the person's expression, even identify their emotion.”
From brainstorm to breakthrough

Fanning the flames of innovation

As a spark is to a fire so is an idea to an innovation. Since time immemorial, just as sparks have flown and blinked out, promising ideas have flickered and fizzled. Only the fateful interplay of atmospheric conditions and environmental circumstance permits either of the former to realize its full potential as the latter.

Encouraging the creativity and scholarship that gives birth to new ideas, even while guarding and nurturing the promise of those ideas through to innovation, requires a fertile spawning ground, careful planning and faithful stewardship.

All are key to Binghamton University’s commitment to its burgeoning research programs.
Stories of invention often hinge on unforeseen events — whether strokes of good fortune or opportune accidents — that shake preconceptions to their roots, set off a sea change in perspective and spawn unimagined realizations — all captured in a microsecond of brilliant and unprecedented synaptic connectivity.

A successful researcher himself, Gerald Sonnenfeld, Binghamton University’s vice president for research, knows firsthand about such “eureka moments.” He is an internationally recognized immunologist who works closely with the National Aeronautics and Space Administration and its National Space Biomedical Research Institute. His experiments have been part of eight space shuttle flights, and his research into the regulation of the immune system by the neuro-endocrine systems, including the effect of space flight on the immune system, has led to many breakthroughs.

Sonnenfeld also knows that transforming even the greatest idea into a marketable innovation takes a lot more than good fortune. That’s why he is committed, through sound planning and strategic partnerships, to amplifying the potential of the Innovative Technologies Complex (ITC), a 21-acre parcel of land that promises to help the University realize its research and economic development aspirations.

Sonnenfeld and a cross-disciplinary committee of faculty and staff have spent the past year devising a no-nonsense management plan designed to position the ITC, through development of the existing 92,000-square-foot building on the site. Their goal is to spark economic development in the region through applied research in the life sciences, enabling sciences and associated support technologies.

The building, known informally as the Alpha Building, has been under renovation since the University received $15 million in funding from the Gen*NY*sis program with help from New York State Sen. Thomas Libous. In addition to providing collaborative research laboratories and related offices, the building will house a clinic for clinical trials, a pre-incubator to support establishment of University-spawned or University-related businesses and the Division of Research, which supports and administers faculty research grants and helps to manage and protect the ideas and breakthroughs, or intellectual property, resulting from faculty research.

The grounds of the ITC are also slated for future development, and the University will receive $5 million from New York state to begin planning for a second building dedicated to engineering and science, with a primary focus on engineering.

Like the University’s 2005 Strategic Plan, the ITC management plan underscores a strong institutional commitment to the promotion of interdisciplinary and multidisciplinary research. It is designed to nurture applied faculty enterprise in the life sciences, which by their nature tend to be cross-disciplinary, Sonnenfeld said. Laying out the criteria according to which faculty can be assigned space in the Alpha Building will help maximize faculty access and enhance usefulness.
“Seeing is still believing."

of the building, while ensuring against any blurring of the economic development mission centrally linked to the state funding that has helped renovate it, he said.

In general, anyone whose work is externally funded and related to the life sciences or supportive technologies and potentially marketable within five years through the development of new products or processes will be eligible for consideration to move into the Alpha Building.

The flexibility of the building’s design should be of particular importance in fostering cross-disciplinary and multidisciplinary research to help move innovations from the laboratory to the marketplace, according to committee members.

“It’s being set up as a very different kind of space on campus,” said Thomas O’Brien, associate professor of education and a committee member. “This is for a subset of faculty whose research focus tends to consider economic development. The ITC is a special place for that to happen.

“There will be a sort of back-and-forth interaction . . . where the economic impact of the campus can be multiplied beyond the campus,” O’Brien added. “There’s great potential for the region.”

As chair of the Bioengineering Department, committee member Kenneth McLeod will play an important role in helping realize the potential of the complex for the region and for the University. His department last January became the first occupant of the building, and he’s eager to see others move there early in 2006.

“It’s a pipeline,” McLeod said, as he traced a path comprising designated byways on a blueprint of the second floor of the building. “We generate ideas. We move them into the lab where we do proof of principle. Then we move into the clinic where we test prototype products and processes. Then we take the ideas that work and move them out here to the pre-incubator, where we commercialize them and, then, send them out the door as a start-up company.”

The University is already working with a group of venture capitalists who have agreed to help the University evaluate ITC breakthroughs and shepherd them through to the marketplace.

That process is important not just to economic development in the region, but also to the University’s primary academic mission, McLeod said.

“We’re an educational operation. The goal is to educate students. And the question is, what are we educating them to do? We can obviously give them theoretical knowledge and historical knowledge and all of this, but the bottom line is that we want to give them knowledge to succeed in the world.”

Only when faculty model and encourage entrepreneurial pursuits will students see the potential of settling and starting new businesses in the region, McLeod said.

“Seeing is still believing. We can go into the classrooms and tell students all about their wonderful opportunities out there. But if they don’t see it happening, if they can’t be involved in these start-up companies in some way, they’re never going to believe it.”

McLeod thinks faculty will also benefit from an expanded scope of opportunities made possible by the ITC.

“The energy or the dynamic of a research operation is very much focused on who is crossing paths with whom on a regular basis. That’s the exciting thing about an interdisciplinary environment. You don’t have to hunt people down. They’re there by the water cooler. They’re there by the coffee pot. That way you can say, ‘You know, I’ve been thinking about this problem.’ That’s where ideas come from, and it really has to happen spontaneously. You can’t create that same environment on a
formal basis in a meeting,” he said.

Though the Alpha Building is essentially targeted for commercializable research related to life sciences and supportive technologies, that definition leaves room at the table for faculty and students from a wide range of disciplines, McLeod explained.

“I’m hoping to see every school and every department represented here. I’d love to have a statistician over here. Anyone in biology or nursing, engineering, economics, political science, business, sociology or psychology — anyone who would normally be involved in any way in commercial developments,” he said.

Sonnenfeld, too, is eager to see completion of the remainder of the building in early 2006, but plans even then do not call for full occupancy of the building.

“We have to plan for growth over the next couple of years as more people are hired to engage in these kind of activities,” he said. “Our planning involves reserving some space in the building for future growth in applied research in life sciences and related technologies.”

Core research spaces in the building will mitigate the need to duplicate expensive equipment and facilities.

“It will offer a very modern up-to-date facility to existing faculty who have an interest in working in this area as well as to new faculty,” Sonnenfeld said. “The laboratories are set up differently than the laboratories most people are used to. It’s all being done with the newest technology, which involves laboratories that are flexible and modular.”

That’s important because in a keenly competitive external funding environment, current events and political exigencies can turn yesterday’s productive research directions into dead ends overnight.

“For the most part the laboratories will be open laboratories, which means that people will have space in big laboratories rather than small closed-off laboratories, and that will foster interaction. But based on need and availability, where smaller spaces are required because of the demands of the work, we’ll be able to modify that and give people smaller spaces as well,” Sonnenfeld explained.

As stewards of University-based innovation, the ITC management committee has taken its planning seriously, and no planning process is complete without concrete benchmarks against which performance can be gauged and from which the need for course corrections can be determined, Sonnenfeld said.

“We’ll know we’re successful when we see several factors. The first is an increase in research activity at the University, which is measured by publications and receipt of extramural funding.

“We’ll also know when we see a big increase in the number of disclosures and patents.

“And we’ll know when we see an increase in the number of new companies formed and licenses of technologies to existing companies. In that order, these will be the benchmarks.”

Achievements of this kind aren’t short-term goals, but for now Sonnenfeld feels confident the University is on the right track.

“It’s going to take several years because it takes years to do research, years to develop a patent and years to develop a product. But if we see increases in these parameters over time, then we’ll know for sure we’re on the road to success.”

McLeod agrees.

“This will be the most exciting thing to watch evolve,” he said. “I see this as a real opportunity to remind the community how [businesses] got started. There’s probably not another community in American society that has started so many fundamentally important businesses.”

We can go into the classrooms and tell students all about their wonderful opportunities out there. But if they don’t see it happening, if they can’t be involved in these start-up companies in some way, they’re never going to believe it.”

— Kenneth McLeod, Chair, Bioengineering Department
From clever clothes

You walk into a dark room and, though there are no wires or switches to be seen, the walls light up, illuminating the space as if by daylight. You reach into the closet, which is similarly lit, and pull out a jacket. The jacket is made of a material that senses environmental conditions around you and adapts itself to provide just the right amount of insulation for prevailing conditions. It will keep you comfortable all day even though your plans include a mid-day walk on a hot beach followed by an evening at the local ice rink. It also changes color and texture as needed to complement your outfit.

On your wrist you sport a flexible band that precisely monitors your vital signs throughout the day and will inform you if a visit to the doctor seems in order. If you prefer a remote consultation, it offers wireless electronic data transfer. The same band senses and alerts you to environmental toxins, serves as a digital watch and acts as a GPS receiver with mapping functions to ensure you’ll never again lose your way, whether in the woods, at sea or exploring a strange city. Like your jacket, the band changes color to match your outfit or mood. But you own several anyway because you paid just $5 apiece for them at Big Lots.

It all that sounds like a futuristic daydream, Bahgat Sammakia suggests you keep in mind one very salient fact: The development of roll-to-roll electronics manufacturing will create a flexible electronics revolution that will soon be turning science fiction into everyday reality — and everything described above is likely to be commercially available and increasingly affordable within the next decade.

Sammakia ought to know. As director of the Center for Advanced Microelectronics Manufacturing (CAMM), he is spearheading what will be the first basic research and development facility for roll-to-roll (R2R) electronics manufacturing in the world. By the middle of 2006, a new research and prototype manufacturing line, comprising cutting-edge equipment never before used anywhere, will likely be up and running in modular clean rooms at the CAMM laboratories at Endicott Interconnect Technologies in Endicott, N.Y., according to Sammakia.

“As far as we know, we will be the first in the world to put this roll-to-roll process to the test,” Sammakia said. “Even as far as the equipment we’ll be using, there’s nothing out there like this. Everything is one of a kind.”

Most advanced electronics components are produced on silicon or quartz wafers, or on plates of specialized glass in a “batch” process that has been the backbone of the integrated circuit and flat-panel display industries. “Growing” a 12-inch silicon wafer, the gold standard in the industry today, is a costly and exhaustive process that can take weeks to months. Even flexible electronics need to be built on frames, limiting their size and application.

By comparison, Sammakia explained, the CAMM’s R2R line will be capable of producing continuous flexible product up to two feet wide and many yards long. Refinement of the tools, processes and materials involved should pave the way for manufacturing facilities capable of producing electronics at the rate of many feet per minute, driving down costs, speeding production and dramatically increasing potential applications.

“It’s comparable to going from a press that prints one page at a time to (web) printing,” Sammakia said. “If you have a printing process printing one page at a time, it’s always going to be limited in terms of speed, whereas if you have a roll-to-roll process, you can churn things out as quickly as you can run the roll.”

Speeding the manufacturing of flexible electronics is just one advantage of R2R. Another big advantage is that it will allow for the manufacture of new products using new materials and new methods.

“Using this manufacturing format, you could potentially produce a flexible electronic banner that could be wrapped most or all of the way around a football stadium,” Sammakia said. “Certainly, tens of yards long.” Long enough, for sure, to make a seamless, continuous piece of electronic cloth from which “intelligent” clothing could be fashioned.

A specialized R2R facility would also be much less expensive to build and operate than a 12-inch silicon line, making it, across the board, an attractive business proposition.

“The cost of a 12-inch line is several billion dollars. People use numbers like $3 billion to $5 billion,” Sammakia said. “Whereas if you build an R2R manufacturing line for something as specialized as a distributed lighting — the equivalent of wallpaper that emanates light, that entire line should cost no more than tens of millions of dollars.”

Though Sammakia says the R2R process will not replace silicon for high-end computing, by speeding the manufacturing process for lower-end
microprocessors and significantly expanding the possible size of products, R2R promises to make possible a host of new, heretofore unattainable applications and products even as it makes a wide range of currently available products much more affordable.

Major electronics, materials and display companies are showing keen interest in partnering with the CAMM, and not just to take advantage of its basic research capabilities.

“The next step is that this line will also be suitable for building actual products,” Sammakia said. “So if we’re working with a company on developing a flexible display or a sensor patch that will be used in some biomedical application, we’ll be able to build those prototypes on this line.”

Within four or five years, Sammakia expects the CAMM to be logging $5 million to $10 million per year in research expenditures, while it works with up to a dozen full-member companies and 20 or more participating member companies to define and resolve the problems of moving flexible substrates through lithography and coating equipment with circuit resolutions much finer than the human eye can see.

The CAMM was made possible in January 2005 when Binghamton was selected in a spirited national competition to receive more than $10 million in equipment and funding from the United States Display Consortium (USDC). A collaborative effort among Binghamton University, Cornell University and Endicott Interconnect Technologies, the CAMM is in line to receive another $1 million to $2 million in support from the USDC and the Army Research Laboratory this year. The CAMM also maintains close ties with the U.S. Army-funded Flexible Display Center (FDC) at Arizona State University (Tempe, Ariz.) on display-related R&D.

Mark Poliks, senior engineer/scientist and manager in research, development and intellectual property at Endicott Interconnect, said the new manufacturing technology that will be created by the CAMM will attract the interest of military, aerospace, medical, computer, energy, lighting and consumer electronics systems industries worldwide.

“There will always be lower-cost regions and developing economies where certain manufacturing processes can be performed at lower costs,” Poliks said. “In order to remain globally competitive, the United States needs to focus on developing new technologies and less labor-intensive manufacturing processes.”

The CAMM will help create high-skill jobs and generate opportunities for the development of intellectual property. These, in turn, will open new markets.

“Working together as a team, we won this opportunity to create new manufacturing technology that will eventually change the way the world uses electronic devices,” Poliks said.
Historically, only a few breakthroughs have significantly extended human life expectancy: antibiotics for treating once-fatal infections, vaccines for preventing childhood and adult diseases and sophisticated assessment and warning systems that save lives and spare injury during severe weather.

In the decades ahead, all that is likely to change. The scope of “health care” has broadened, and technology has entered the healthcare arena in a much more prominent way. Prison inmates and persons who live in remote areas now routinely have their eyes, teeth, heart and other body parts examined via sophisticated tele-technology. At highly respected hospitals, surgery residents are honing their craft using computerized simulators. Even real-life surgical procedures are now sometimes supervised from afar by highly specialized surgeons who never come in contact with the patient and have no need for sterile gloves. Instead, even from a different continent, doctors using computer monitors are able to observe and oversee delicate operations. Significant advances in global health will continue to be achieved as a result of technology-based research and educational programs.

Health has become a prime concern in the global community. A successful global health initiative will have to address such longstanding social conditions as poverty, crime, access to resources and disaster preparedness. But it will also have to attend to more obscure personal habits. Sedentary lifestyles, overeating and smoking have significant health consequences even among the more affluent segments of contemporary society. In the face of such complex challenges, technology alone stands to provide answers that can reach around the world.

It is ever more critical, therefore, that we educate healthcare students in a state-of-the-art technological environment, a challenge that Binghamton University is equipped to take on thanks to the Decker School of Nursing’s new Innovative Practice Center, made possible by a gift from the Dr. G. Clifford and Florence B. Decker Foundation.

The center is being designed and equipped with leading-edge clinical simulation technology, and will prepare students to better recognize and manage physiologic emergencies, so their responses will be quicker and more confident in actual clinical situations. Whether acute or chronic, every episode of health care starts with the detection or recognition of conditions or symptoms that signify an immediate or ensuing health risk. In virtually all scenarios, the outcome is better when recognition occurs in time to initiate effective treatment or life changes.

Binghamton’s simulation laboratory will also provide a safe and non-threatening learning environment for students and professionals in the community to learn to recognize signs of physiological compromise quickly and to perform complex corrective procedures while there is still time to make a difference. Such practice will enhance the learner’s capacity to avoid or catch errors in judgment before harm is done.

Through scientific advancements, including sophisticated technology, we have substantially increased the hope for longer life, but as the world’s population ages (as evidenced by a dramatic increase in the number of persons living to be 85 years and older), health as it has traditionally been defined will no longer be a realistic goal for many. Our challenge now is to innovatively apply technology to manage chronic illness and engender a sense of well being, even in the face of declining health. The Innovative Practice Center
will enable a seamless blending of education, practice and research to promote and accomplish that goal.

The center will also function as a high-tech training center without walls. The technology will allow faculty and students, along with community healthcare partners, to improve health care in critical-care areas of the hospital as well as in homes and regional communities. In addition, as a regional hub for training and certifying students and the public, including area hospital personnel and community response teams, the center will enhance community emergency care and disaster preparedness.

In concert with the University’s Innovative Technologies Complex, which also provides an open learning environment for the acquisition and application of new knowledge, the Innovative Practice Center will create a climate where new ideas can emerge freely, helping us to envision and design a healthier tomorrow. That technology will lead to and support clinical trials that test interventions to improve health and facilitate the broad dissemination of information about best practices to professionals and laypersons alike.

The traditional hospital setting no longer dominates the healthcare arena. Rather, hospitalization is today reserved for the most acutely ill, who are likely to be discharged within hours instead of days, often with complex medication protocols, intravenous lines or small rolling oxygen tanks. Care teams now follow healthcare recipients and their family caregivers into their homes, workplaces, schools and even homeless shelters and prisons. Amputees with programmable prostheses and persons with organ transplants now live near-normal lives at home. And the surgery experience has increasingly become an outpatient event.

Present and emerging technology affords the means not only to discover new knowledge but also to ensure that it will inform our future healthcare policies, practices and individual choices. Facilities such as the Innovative Practice Center and the Innovative Technologies Complex will help to prepare technologically savvy healthcare providers who can confidently and competently take on the challenges and the consequences of improving health care in the 21st century. — Sarah Gueldner

Sarah Gueldner is a professor and former dean of the Decker School of Nursing. She holds a doctorate in nursing from the University of Alabama at Birmingham, with a concentration in higher education. Her research interests are in the areas of aging and adaptation with chronic diseases.
We’re not talking about some virulent new parasite, bacterium or virus. We’re talking instead about microprocessors — the ubiquitous little “brains” that drive everything from personal computers to cell phones, TV remotes to supercomputers, and electronic games and microwaves to complex defense systems.

Central to most of our professional and many of our personal activities, microprocessors are at the heart of a vicious circle that a team of Binghamton researchers, led by computer scientist Kanad Ghose, intends to help tame. This is one of the first research groups in the country — in academe or industry — to tackle the need to develop low-power computing strategies. Their success could mean savings of more than $10 billion per year in utility costs in the United State alone. That’s part of the reason Binghamton University’s low-power computing group is attracting interest and funding from the National Science Foundation, the Defense Advanced Research Projects Agency (DARPA) and the electronics industry itself.

Microprocessors comprise clusters of transistors that act like microscopic pumps and valves to regulate the flow of electric current within electronic
devices. They are divided into two varieties: special-purpose microcontrollers such as those found in electronic appliances, watches and cell phones, and the more complex microprocessors used in such computationally intensive applications as PCs, servers, supercomputers and game players.

For all the good they do, as currently designed, microprocessors are a one-size-fits-all conservationist’s nightmare. They are essentially designed to run full blast, regardless of the relative complexity or simplicity of the job they will be called upon to handle. As a result, in computers, the simplest word processing job gets as much dedicated microprocessing torque as a multimedia application. It’s as if your car’s engine was turning maximum revolutions even at idle, and the results are what you would expect, Ghose said — a lot of wasted energy.

With the speed and capabilities of microprocessors increasing logarithmically, the problem is likely to get much worse unless solutions are implemented.

“Every 18 months the electronics industry has doubled the number of transistors on a chip,” Ghose said. “And this trend is not going to stop. We’ll be pushing at faster and faster clock rates at the same time.”

Clock rates are the rate at which instructions are executed by a microprocessor. Clock speeds are expressed in megahertz (MHz) or gigahertz (GHz). The faster its clock rate, the more instructions a computer can handle in a given time. But fast clock rates also mean an increase in the rate at which transistors within a microprocessor have to switch on and off, and quickly switching microprocessors on and off generates lots of heat, which then requires cooling solutions.

“Look at the PC,” Ghose said. “We have a microprocessor chip that produces 50 to 100 watts of power in a space the size of one square centimeter. To cool that down we put in two fans, and these fans themselves consume half of that power.”

Today, the average microprocessor takes only seconds to reach the temperature of an iron and many run hot enough to fry an egg. If trends continue unchecked, five years from now, microprocessors could be getting as hot as a rocket nozzle. In another 10 years, they would be dissipating more heat per square inch than the sun — a condition that would be untenable for the industry and would spell the need to roll back processing power to within the temperature limits of packaging materials.

“It’s getting to the point where they will either have to cut back on clock speed or reduce the number of transistors,” Ghose said. “The industry won’t want to do that because it would mean a leveling off of all the performance improvements we’ve seen over the years. Ultimately, to really address this problem, you have to do something intrinsic to the chip design. Packaging heroics can only go so far.”

Ghose’s low-power computing group, comprising six faculty and between 15 and 20 students, has already designed several prototype chips that use 40 to 60 percent less energy than the industry standard with a negligible loss in performance. The chips are capable of responding to computational needs on the fly, using only the minimum amount of processing power need-

Innovations in low-power computing are also key to the continued development of improved cell phones, media players, digital cameras and PDAs, where advances will mean prolonged battery life and enhanced functionality. Medical applications such as ingestible cameras, smart drug delivery systems and pacemakers, which all must run consistently and reliably on battery power, will also benefit greatly from low-power chip design, Ghose said.

Even with the existence of Binghamton’s successful prototypes, Ghose said it will take time for the electronics industry to wholly embrace new low-power computing strategies, which would require a complete retooling within the industry. He thinks improvements such as those being designed and refined at Binghamton will begin making their way into consumer products within the next five to seven years.
Plugging (in) the Arts

Computers and technology can provide a wall of sound and put a spotlight on center stage, but the hands of an artist will still be pushing the buttons.
From the time he arrived at the University 36 years ago, John Vestal has been plotting murder, mayhem and intrigue . . . as well as comedy, opera, ballet, rock concerts and other live performances. In fact, in a career that has spanned the globe, he has “plotted” more than two dozen operas and more than 250 theatrical productions.

Vestal designs and drafts the theater “light plots” that help set the mood and realize the director’s vision for stage productions. Light plots, which indicate exactly what lights will be used — and how and when — can spell the difference between a successful performance and a flop. As professor and chair of Binghamton University’s Theatre Department, Vestal has traded hand-drafting of his plots for the ease and the wizardry of technology, developing an extraordinary expertise and new insights into theatrical staging along the way.

When Vestal sits down to set the stage, he does so quite literally by opening a program called VectorWorks on his computer. With a few clicks of the mouse, he brings up the schematics of the Watters’ and the Osterhout Concert Theater’s auditorium and stage — plus every single light involved with both. On the schematic, the lights — each with a different purpose and designed to be hung for a specific space — appear almost as if they are missiles waiting to be deployed. In fact, that’s pretty much what Vestal does. He uses the software to plot the scenery, to track audience sightlines to the stage and backstage and to model the effects of lighting on both. He also manipulates area lights for the 8-feet-square stage section from which every light plot begins, and then adds lighting in the areas surrounding it. Lights are also pivoted to suit the production director’s fancy, and Vestal tosses in his special blend of experience and expertise to punch up the effects to ensure a stellar architecture within which performers can most effectively ply their trade.

Vestal says using the technology is “fantastic” and not just in terms of more efficient drafting or the ability to change a plot or sections of it within seconds: “We know our work will be there every night, and in that way, technology has been a godsend.”

But technology doesn’t come cheap. One set of four lights on Vestal’s wish list costs $80,000, so the University has taken a reasoned approach to strengthening its capabilities by adding hardware as funds have become available. Fortunately, that has allowed for some major improvements to ensure that students and faculty get to work with equipment that meets or exceeds most standards within the industry, he said.

“Five years ago,” Vestal recalled, “Watters had 30 dimmers and the department bought 24 more. Today, we have 296.” Gone are yesterday’s patch panels — a way to assign circuits to dimmers and outlets — because “with technological innovations, it was cheaper as well as easier to assign one circuit per dimmer,” Vestal said.

Despite the availability of innovative technology within Binghamton’s Theatre Department, Vestal nevertheless expects “some students to one day tell me that I’m responsible for cramping their fingers and hands as they created the cues I conceived on a 1959 vintage light board,” he said.

That’s because Vestal insists that students who take his stage-lighting courses not only learn how to manipulate modern lighting technology, but also that they be fluent in the “old way” of drafting stage-lighting plots. That way, no matter what happens — from a disruption in technology to a stint in antiquated theaters, the student will
have the experience and expertise to turn out a design by hand.

Ultimately, Vestal’s growing expertise with light-plotting technology allows him and his students to conduct important research in their field — research that will lead to a studied understanding about the full effect of the technology and how it can be nuanced to the director’s vision and within the context of a production.

With today’s technology, it’s very easy to light a scene and a production, Vestal said. But just because something can be done doesn’t mean it should be done.

“It’s all about creativity,” he said. “Technology makes achieving the ideas you have easier and more repeatable. But human subtlety and artistic integrity have to be there, too.”

Not Your Father’s Fender

“Technology makes achieving the ideas you have easier and more repeatable. But human subtlety and artistic integrity have to be there, too.”

John Vestal
Professor and Chair of Binghamton University’s Theatre Department

Technological advances have made it easier to create designs for stage lighting, but Vestal emphasizes the importance of artistic vision and creativity.

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**Ligopoly for Wind Ensemble, Pelé’s Steps for Soprano and Five Timpani, and Suite for Piano** are only a few of the musical works composed by Timothy Rolls ‘94, adjunct professor of music at the University since 1999. His works have been performed at home and abroad.

But not all of the “instruments” for which Rolls composes can be found in the orchestra pit. He has also created *Enigmatic for Computer-Generated Sound; Orbit for Computer-Generated Sound and Flash Animation; Terror Strikes for Violin and Recorded Media; and Ix for Two-Channel Tape.*

If that sounds high tech, it is, and Rolls taps into it for his cutting-edge electro-acoustical works as well as uses it to teach music-loving students who grew up with technology and are excited about finding ways to adapt it to their own creativity.

A teacher of orchestration, music theory and computer and electronic music, Rolls helped develop the University’s Musical Instrument Digital Interface Lab — MIDI Lab, for short — where 10 Macintosh computers are MIDI-interfaced with MIDI synthesizers. MIDI is a computer protocol that allows musical instruments and computers to talk to each other. It enables performers and composers to control multiple instruments from a single keyboard and, with hardware and software extensions, to record, edit and play back performances as well as compositions for, say, a traditional quartet without the four-person ensemble present.

The technology is available to all students taking music classes and is incorporated into Music Theory classes. Knowing how to read music and, especially, having familiarity with a keyboard helps, since composing or orchestrating with a MIDI requires using a keyboard and knowing music notation.

The University’s MIDI applications include both the Sibelius and Finale music notation systems. A sequencing package called Logic Express allows students to compose music on the fly and is similar to a sound recording. SmartMusic ensures that student and faculty performers never practice alone: It allows a performer to play an instrument into a microphone and then follows the performer’s tempo; it can also evaluate the performance (e.g., a late entrance) and offer suggestions (increase tempo).

That’s a lot of technology, but it can’t do a thing without the artist. MIDI, says Rolls, is about allowing a performer or composer to do something a bit less ordinary. “It is an innovation that helps students enhance their performances and their skills, and is another way to exercise their creativity.”
Everything about autism seems to be shrouded in fog. No one knows what causes it, and heated debates rage about how it can — and even whether it should — be treated. Using new technology and a unique approach, Binghamton University researchers are cutting through the mist and the mysteries surrounding the confounding and complex group of disorders commonly known as autism.
Raymond Romanczyk, director of Binghamton University's Institute for Child Development, has worked for more than three decades in the fields of autism and child development. Now he is heading up an intensive research project designed to learn more about how children — with and without autism — interact with the world around them. The work promises to spawn more effective interventions to help autistic children deal with their most common and problematic areas of deficit — social and life skills. It’s a challenge Romanczyk doesn’t take lightly.

“In the field in general, people haven’t been successful in the remediation of that problem area,” he said. “We’ve taken it on as sort of a focal point. For instance, the last five dissertations in [our] lab are all on social processes.”

A combination of a state-of-the-art eye tracking system, miniaturized psychophysiological monitoring and multiple computers for high-speed processing is enabling Romanczyk’s research team to ask questions that could help answer how individuals with autism process information and stimuli from the world around them.

“If I ask you a question and you respond, chances are you were paying attention,” said Romanczyk. “But if you’re a child who doesn’t enjoy social interaction, is unmotivated and doesn’t respond in general to adults, it’s like this black hole. Is the question going in and it’s just a failure to respond, or is nothing going in and that’s why nothing is coming back out?”

While many have conjectured about what children with autism are experiencing, there has been a dearth of scientific data about the subject.

“There’s a lot of smoke and mirrors in the literature about autism,” Romanczyk said. “Some say this works or that works. Our informal motto is ‘Well, it depends.’”

Romanczyk thinks a major reason “smoke and mirrors” tend to prevail around autism is that basic research has been conducted only on a limited population of those with autism, usually older children who are considered “easier” to work with. Assessment techniques that attempt to discern underlying cognitive and relational issues by tracking eye movement have been used with this group, but with a hitch. The technology has generally required that subjects wear an awkward apparatus on their head, and most children, especially younger ones, balk at wearing the gear.

Romanczyk and his team, Jennifer Gillis (doctoral candidate), Wayne Kashinsky (systems engineer) and Eric Ma (software development), and numerous undergraduate students, are tackling that obstacle with a new technology they informally call “our setup.” Its formal name, the “multi-method simultaneous assessment of psychophysiological, attention, motivation, performance and behavior measures,” makes it clear why the nickname has stuck.

The “setup” employs a tracking system that doesn’t require the subject to wear a tracking device. Instead, a video camera built into a small desk observes the face of a subject, usually a child. First, reference points are established by having the child watch a short animation, and with the help of a powerful computer program, the system overlays the position of the child’s eyes onto a second video image of the child’s field of view. While the tracking system ob-
where the differences lie between non-autistic children and children with autism. The new technology is enabling institute researchers to ask questions that may have far-reaching implications for educational and clinical approaches to autism.

“Part of the reason for this elaborate scheme is we’ve also been doing some research on how adults interact with children with autism, how they perceive what they think is going on versus what the child is actually doing,” said Romanczyk. “This ties into all the subtleties of social interaction that we take for granted. You look at someone and you can tell by their body posture, their gestures, tone of voice, eye gaze and so on, what’s being communicated. With children with autism, it’s more difficult to do.”

The institute has been using the setup for a little more than a year, barely “scratching the surface” of its potential, Romanczyk said. Hopefully, the technology will bring more objectivity to the diagnostic process, especially early diagnosis, and allow researchers to study subsets within the autism spectrum, such as individuals for whom social interaction is not only undesirable, but also provokes anxiety.

Child psychologists have been moving in this direction, realizing the need for more objectivity about something as complex as social interaction, Romanczyk said. Last year, a national news story broke, he said, about a Yale University study of visual processing in which teenagers with autism were shown the motion picture *Who’s Afraid of Virginia Woolf?* and asked to comment on the film’s content.

“That’s an interesting group to work with and the information is useful,” he said. “We’re at the other end of the spectrum, asking much more basic questions on behalf of the children who can’t speak to us, or only in a limited fashion.”

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**What is autism?**

Autism is the common term for autism spectrum disorders (ASD), developmental disabilities characterized by deficits in three major areas of functioning: communication, social interaction and restricted behavior patterns. Someone diagnosed with autism may or may not be able to communicate verbally, may display limited or no social interaction and may or may not display stereotyped self-stimulatory behavior and repetitive ritualistic behavior. The IQ range of individuals with autism is broad, from a severe degree of mental retardation to normal IQ, but the majority display significant mental retardation, cautioned Raymond Romanczyk, director of the Institute for Child Development.

The prevalence of autism has become a highly controversial topic. Historically, autism has been viewed as a rare disorder, occurring in approximately 4.5 per 10,000 children. However, during the past several years, higher prevalence rates have been recorded, in some cases as high as 20 to 50 in 10,000 children. There is no clear indication why, said doctoral candidate Jennifer Gillis, BA ‘99, MA ‘02.

“Some of the viable hypotheses for the increased prevalence of autism diagnoses are more awareness of autism, better diagnostic instruments, an increased emphasis for early identification, which leads to early intervention services, and a broader definition of autism than has been used in the past,” said Gillis, who is a clinical psychology intern at the Brown University Consortium. “There are some proponents of possible environmental causes, but based on current research this is only speculative.”

Image is for illustrative purposes only and the person in the image is not a person with autism.
Muscle stimulation might help stave off type 2 diabetes

If you don’t exercise, you increase your risk of developing type 2 diabetes, an ailment that health officials say has reached epidemic levels. Leann Lesperance is looking for ways to improve the odds against that without anyone breaking a sweat.

Lesperance joined the faculty at the Watson School in 2004 and also serves as clinical assistant professor of pediatrics at SUNY Upstate Medical University’s Binghamton Clinical Campus. Along with her MD, she holds a PhD in medical engineering. She has served as a lecturer at Harvard Medical School and is an editor with Harvard Health Publications/InteliHealth.com. Her current research interests include healthcare quality and type 2 diabetes.

Unlike patients with type 1 diabetes, many with type 2 do produce insulin, the hormone required to process sugar. But type 2 patients don’t use their insulin effectively. As a result, their cells may become starved for energy, and the buildup of unused glucose over time may damage the eyes, kidneys, nerves and heart.

Together with Ken McLeod, chair of the Department of Bioengineering, and graduate student Anna Spektor, Lesperance is trying to learn whether Preliminary test results look encouraging. In at least some of the subjects, “the stimulation is showing a positive effect,” Lesperance said.
A device called the Juvent 1000cs can help lower the risk for type 2 diabetes, particularly among people who live sedentary lives. Developed by Juvent, Inc. of Somerset, N.J., the Juvent 1000cs looks something like a bathroom scale. A plate on its surface vibrates at a frequency of 45 Hz. When a subject rests his or her feet on the plate, the vibrations stimulate receptors in the feet, which in turn send signals to the calves, causing the muscles to contract.

It already has been demonstrated that the vibrating plate can help improve cardiovascular function. “The theory is that it’s stimulating your muscles, doing things as if you were standing up and moving around,” said Lesperance. The success of these earlier experiments has led researchers to wonder if the vibrations could take the place of exercise to improve other health factors as well. “And a natural extension of that was to think about diabetes, because we know that exercise improves our blood sugar control.”

Starting in the fall of 2004, Lesperance and her team have recruited women — none of whom have been diagnosed with diabetes — to take two oral glucose tolerance tests. After drinking the glucose solution, the women spend three hours with their feet on a Juvent 1000cs, once with the vibration turned on and once with it turned off.

A tiny, catheter-like sensor, inserted under each subject’s skin, monitors the level of glucose in the blood during both three-hour tests. “We see how high it goes” after the subject drinks the solution “and how fast it goes down,” Lesperance said. Preliminary test results look encouraging. In at least some of the subjects, “the stimulation is showing a positive effect,” Lesperance said. “I can’t draw any statistically relevant conclusions at this point, but we’re getting data that suggests that there is some clinical effect to this device on the utilization of glucose by the body.”

Juvent has provided ongoing support to this project. It will also match dollar for dollar a $537,000 grant McLeod received last year from the New York State Office of Science, Technology and Academic Research (NYSTAR) for further work with the Juvent 1000cs.

That research is still in the planning stage, but Lesperance hopes to use several additional techniques to further examine how micromechanical stimulation affects glucose uptake. One proposal is for a long-term study in which subjects would use the vibrating plate during the workday for six months. Researchers would periodically measure a substance called hemoglobin A1C, which reflects the level of sugar in the blood over the previous two to three months.

The team also wants to explore the immediate effects of the vibrating plate, using a positron emission tomography (PET) scan to see how much the calf muscle absorbs a labeled glucose molecule. “We were thinking that we would do one leg on [the device] and one leg off and see if you could see the difference,” Lesperance said. She has talked with a physician at United Health Services in Binghamton about possibly using that institution’s PET scan equipment.

Another proposal is to use equipment at SUNY Upstate Medical University to conduct a procedure using a euglycemic insulin clamp. This technique allows researchers to control precisely the levels of insulin and sugar in the bloodstream, eliminating any extraneous factors that might affect test results. “We might be able to work out a test where we can learn even more about what’s happening to the whole body glucose uptake during the use of this device,” Lesperance said.

Since exercise improves a whole range of health factors, the Juvent 1000cs might help prevent other medical conditions as well, noted Lesperance. Examples are blood clots in the leg, a hazard that afflicts airline travelers, and osteoporosis.

Clearly, the vibrating plate has effects throughout the body, Lesperance said. “The question is going to be, what’s the mechanism, and how do you maximize it?”

An assistant research professor of bioengineering in Binghamton University’s Thomas J. Watson School of Engineering and Applied Science and a pediatrician with Binghamton Pediatric Center, Leann Lesperance is leading a team that’s exploring whether micromechanical stimulation to the feet can help improve the way the body uses glucose.
Cutting across the bias:
Crafting a new reality for gay, lesbian, bisexual or transgendered youths
Mitch Rosenwald knows he can’t put a stop to the kind of ignorance and bigotry that results in significant numbers of GLBT children being cast out by disapproving parents or having their unique needs ignored by school, church and community groups. He’s determined to make a difference though. He hopes to do that by advocating changes that could help end heterosexual bias in U.S. child welfare agencies, where dispossessed and troubled GLBT youth comprise a disproportionate percentage of those being served.

Known in social work circles as “GLBT,” these youths are distinguished from any other group of children only by their gay, lesbian or bisexual sexual orientation or transgendered identity. According to statistics, this group is so subject to bigotry and bias that they might be better off if society paid them no mind at all — if they could become what many of them seek to be: invisible. Once discovered, some studies suggest, more than 30 percent of GLBT youth are rejected by their parents and families.

Acceptance seems no easier to find on the streets. At school and in their communities, more than 80 percent of surveyed GLBT youth say they are subject to relentless verbal harassment. Seventy percent say they live in daily fear for their physical safety. Even in foster care, almost 80 percent of GLBT youth were removed or ran away from at least one placement due to blatant hostility, several studies have shown. As a result, according to the National Network of Runaway and Youth Services, these children probably account for between 20 and 40 percent of all homeless youth in the country.

Mitchell Rosenwald, assistant professor of social work, wants to help change all that, starting with a unique research project that could help promote reforms in the child welfare system. A former child protective worker who believes child welfare workers and agencies are generally well intentioned albeit overworked and hampered by bureaucracy, Rosenwald thinks the need is clear.

“These are children who are already feeling different. We can either further isolate them or we can make room for them. A system that’s supposed to help children doesn’t need to further isolate them,” he said.

“Our society is one of heterosexism, and, so, children are treated based on those norms,” he said. “There’s not always a lot of malice here, but there is a real lack of awareness.”

Where research exists on GLBT youths, it has generally been based on urban studies, Rosenwald said. These studies suggest a higher propensity for these children to be abused or neglected, for them to have unsafe sex, have problems with addiction, become involved in prostitution, have trouble in school and face higher risks of HIV and hepatitis. There haven’t, however, been many such studies on GLBT youths in rural locations, and even fewer on GLBT youths in foster care, he said. His work, which focuses at least in part on rural foster-care respondents, will help to remedy that.

Rosenwald’s three-pronged, ongoing project includes studies with GLBTs who have “aged out” of the child welfare system, with foster-parent focus groups and with child welfare agency directors via an Internet survey. The project builds on earlier work he completed with foster-parent groups in Baltimore, where interviews and focus groups revealed the prevalence of enduring negative stereotypes. Foster parents who said they would be reticent or unwilling to take in gay male foster children cited concerns that the boys would make unwelcome sexual overtures toward other children in the home or would insist on wearing dresses, Rosenwald said.

“These were all very well-intended people who, like all of us, are a product of their time,” Rosenwald noted. “But the persistence of these stereotypes, arising from layer after layer of prejudice, likely contributes to the difficulty many GLBT youths have in finding safe placements.”

When his broad-based project is finished, Rosenwald expects it to further demonstrate the need for sweeping implementation of recommendations such as those contained in a seminal 1991 publication, which addressed the need to make child welfare agencies more responsive to the needs of gay and lesbian youths, but for more than a decade has gone largely unheeded by child welfare systems.
Published by the Child Welfare League of America, “Serving Gay and Lesbian Youths: The Role of Child Welfare Agencies — Recommendations from a Colloquium” espouses 43 recommendations intended to “help child welfare agencies better serve gay and lesbian youths, and assist all youths in their care to better understand the damaging effects of prejudice and bias.”

Policy recommendations include such things as integrating the needs of gay and lesbian youths into service planning and implementation and adding sexual orientation to agency by-laws, client admissions, and recruitment and nondiscrimination policies. Recommended new practices include building familiarity with and increasing access to gay and lesbian community services as well as establishing rules of behavior in group-care settings that are the same for all youths, regardless of sexual orientation. Other recommendations are that child welfare agencies encourage and advocate the inclusion of gay and lesbian youth issues in the curricula of professional schools — including schools of education, social work and nursing — and incorporate references to unmet needs of gay and lesbian youths in legislative testimonies on youth concerns.

“These were excellent recommendations,” Rosenwald said. “More than a decade later, though, my sense is that the majority of child welfare agencies are either falling short on the views of these recommendations or it’s just simply not on their radar.

“In fact, you really don’t see much of anything in the literature about GLBT youth and the child welfare system before or after that publication,” Rosenwald said, “with the exception of Gerald Mallon’s work.”

Gerald Mallon, a professor at Hunter College and director of the National Resource Center for Family-Centered Practice and Permanency Planning, is widely regarded for his work in the field. He has published more than 15 books including *Let’s Get This Straight: A Gay- and Lesbian-Affirming Approach to Child Welfare and We Don’t Exactly Get the Welcome Wagon: The Experience of Gay and Lesbian Adolescents in Child Welfare Systems.*

Like Rosenwald, Mallon thinks widespread adoption of the 1991 recommendations across three arenas — policy, practice and advocacy — would go far to ensure better care for GLBT youth in foster homes and institutions. He said research such as Rosenwald’s is not only important but courageous.

“There’s still an awful lot of stigma attached to doing research with stigmatized populations, and there are still people who think gay and lesbian issues should be kept private — that this is not legitimate research,” Mallon said. “I’m always excited when I talk to Mitch because there are too few faculty doing research in this area. This is important work that needs to be promoted and encouraged among junior and senior faculty.”

At present, few agencies even ask about sexual orientation on intake, presenting a roadblock to the use of more traditional research approaches when it comes to GLBT youth in foster care, Rosenwald said.

“Finding data in traditional ways just doesn’t work,” he said. “You can only analyze records that contain the information, and if no one even asks the question, snowball sampling — where you find one person by word of mouth and then ask them for other contacts — is the only alternative.”

Obtaining external sponsorship for research in this area is also a problem, according to both Rosenwald and Mallon.

“I had absolutely no funding to write any of my books ever,” Mallon said. “I spent my own money and did what I had to do because this is an issue that is not going to go away.”

Ultimately, Rosenwald expects his research findings will help demonstrate the need and build support for widespread adoption of the 1991 recommendations while providing needed advocacy for the children he calls the “most vulnerable of the vulnerable”: GLBT youths living in the child welfare system, without the support of their families.
Are we having fun yet?

An organization’s leaders and followers should be, if they aspire to creativity.

Work is much more fun than fun — or at least that’s what Noel Coward, actor, composer and playwright, said. As it turns out, his fun attitude about work is exactly what organizations should be cultivating in the workplace to coax creativity from co-workers.
The most intriguing of four conclusions from the first-ever study on creativity, training and leadership shows that leaders who have fun at work energize, motivate and stimulate others to be more creative. The study was conducted by Shelley Dionne, associate professor, and Kim Jaussi, assistant professor, School of Management, in a research partnership with an organization aptly called Play.

Jaussi came across Play — a Richmond, Va.-based creativity and innovation consulting firm that offers creativity training — while developing a curriculum for the required School of Management course, Introduction to Organizational Behavior, into which she and Dionne wanted to incorporate findings about creativity and behavior from an earlier study they conducted [see related sidebar].

The people at Play knew creativity could be cultivated and wanted data to back it up. Jaussi and Dionne wanted to pursue the data and investigate whether people could be trained to bring out their creativity. “And that’s exactly what we did,” recalled Jaussi. She and Dionne designed an online survey called the LEAF Assessment with seed money for development provided by the University’s Center for Leadership Studies and with the full support of its director, Distinguished Professor Francis Yammarino.

Since 2002, participants who have gone through Play’s creativity training — to date, more than 850 people in 23 training groups from Fortune 500 companies — completed a LEAF Assessment three times: before training, immediately following it and three weeks after training. To assess changes in creativity, a colleague of each participant completed a survey about the participant’s creativity at work both before and three weeks after training.

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The creativity training/LEAF Assessment research wasn’t the first time Dionne and Jaussi decided to make some points about leadership and creativity.

When both joined the faculty at the University almost five years ago, leadership and creativity were already business buzzwords being batted around, but there was nothing that definitively correlated the two. “We decided to change that,” said Dionne. In 2001-02, she and Jaussi conducted the first of several breakthrough studies that delivered conclusions with plenty of leadership-to-creativity implications.

To contrast the results of leadership styles on a group, they set up a behavior lab disguised as a kind of forum for groups of juniors and seniors about an educational matter. They trained leaders, developed a script for them to follow and assigned each a leadership style: transactional — for instance, if a group did X, it would be rewarded with Y; or transformational — where exceptional group performance is expected because of inspired leadership.

Leader messages were identical, but Dionne and Jaussi wanted them delivered differently, through either conventional — or what is thought of as normal — behavior, or through unconventional — or what Jaussi describes as wacky — behavior. For example, a conventional, high-transactional/low-transformational group leader simply handed out instructions and asked group members to stand and identify themselves. By contrast, an unconventional, high-transformational leader asked members to wear tee-shirts with instructions on the backs and to spell their names on a table with magnetic letters.

Their seminal research found that a leader who behaves unconventionally — and is thought by followers to be a creative role model — inspires followers, their creativity and group cohesion. For example, Jaussi points to a “positive relationship between an individual who thinks a leader is a role model for creativity and the person’s own creative performance, which, in turn, is strongest when a leader behaves unconventionally, or somewhat on the unexpected side.” And at a group level, this kind of behavior — whether displayed by a transformational or transactional leader — strengthens cohesion, which contributes to the group’s creativity if it has high levels of creative motivation.

A leader who is unconventional also gets high marks. Followers in the second phase of the Dionne-Jaussi study were more satisfied with an experience led by a “fun” leader, and rated this type of leader higher in terms of leader effectiveness.

For organizations, the results provide clear questions to ask about its leaders: Are they viewed as role models for creativity? Do they engage in unconventional behavior that increases group cohesion and creates high levels of group motivation to be creative? Does their behavior enhance followers’ perceptions of their leadership effectiveness? “The answers,” says Dionne, “could determine which organizations achieve and maintain a creative edge — and which ones won’t.”
Creativity at work

Dionne and Jaussi found that creativity training works when an organization and its leaders realize the following:

1. **Having fun is important.** When a leader thinks it’s important to have fun at work, followers see that leader as having fun. They report the leader as stimulating them and others to be more creative at work.

2. **A follower’s self-concept of creativity matters.** Those who believe creativity is part of their personal identity are more creative than those who think they can be creative. Leaders can foster creativity by creating opportunities for followers to view themselves as creative and making it part of their personal identity. “It’s no surprise,” said Jaussi, “that leaders who view creativity as part of who they are also consider themselves to be risk takers.”

3. **The ability to cross-apply non-work experiences to work situations strengthens the relationship between a creative personal identity and creativity at work.** Leaders who provide training opportunities to increase problem-solving skills through this kind of cross-application foster creativity in followers.

4. **Individuals who are more creative view creativity training more positively than those who are less creative.** Creative novices do not rate training as highly as those who believe they are creative. To jumpstart creativity, Dionne advises that leaders consider investing in different levels or types of training for the more creative and for those less creatively inclined.

Because organizations are increasingly focusing on human capital to leverage knowledge in new and different ways to gain a creative edge, Jaussi noted that “LEAF’s major conclusions are bound to have implications not just about training people to have creativity, but about the leaders who instill it.”

Whether today’s managers apply the Dionne-Jaussi conclusions may depend on their organizations’ own take on what constitutes effective leadership and performance, and, for some, a willingness to move away from the more “traditional” corporate cultures of prior decades.

Management of the future, however, should have no problem: Students in the School of Management’s leadership concentration who volunteer and participate in Manley’s Service Learning Projects — University partnerships with community non-profit organizations — have taken to heart their lessons about creativity and creativity training. In fact, Jaussi likened her students’ volunteer work with the non-profits to “almost a leadership and creativity practicum. Feedback has been remarkable,” she added, “with students providing more creative consulting and problem solving than paid consultants, according to one non-profit director.”

Because of the conclusions of their studies, both Dionne and Jaussi find that today’s students “get the creativity thing. They’ve been trained that way. They know to have fun. And so will tomorrow’s leaders.”


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