## Palladian dest

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## **Revving up UNL's** economic engine

Technology development

rom his Q Street office, John Brasch looks out on downtown Lincoln

"In effect, this is our storefront," said Brasch, UNL's associate vice chancellor for technology development. This renovated former copy shop at 1320 Q St. is the new home to the University of Nebraska-Lincoln's Office of Technology Development. It's a physical symbol of UNL's expanding efforts to turn research discoveries into fuel for Nebraska's economy.



Chancellor Harvey Perlman, John Brasch, associate vice chancellor for technology development, and Prem Paul, vice chancellor for research, in front of UNL technology development's new office at 1320 Q Street in downtown Lincoln.

The location – south of campus facing the business district - sends the message that UNL is eager to partner with business. It also represents technology development's increasingly important role in linking university inventors with entrepreneurs who can successfully commercialize their technologies.

"Technology development is the bridge between faculty discoveries and the commercial marketplace," Chancellor Harvey Perlman said. It's responsible for moving university technologies from the lab to practical use for society's benefit. That includes evaluating and marketing faculty inventions and negotiating agreements with companies that pay UNL and faculty inventors for the right to use the university's intellectual property, the technical term for the products of faculty research.

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#### Raising the bar

UNL and its research have long contributed to Nebraska's economy, but Perlman and others are upping the ante. They hired Brasch, a successful entrepreneur and former business professor, they are investing in tech development infrastructure, and they are working with state and business leaders to enhance UNL's economic impact.

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"Our overall goal is to play an even bigger role in strengthening Nebraska's economy," said Prem Paul, vice chancellor for research and dean of graduate studies. Part of the university's responsibility is helping Nebraska and the nation compete in today's knowledge- and technology-driven global economy.

Perlman summarized his vision for enhancing UNL's role as an economic catalyst in his 2006 State of the University address: "The potential for new university discoveries to improve the human condition is unlimited. To fully exploit these opportunities, we will need to marry the creative output of our faculty with the entrepreneurial efforts of the private sector."

Realizing this vision is a long-term endeavor, but it is yielding early successes. In 2006, tech development negotiated 20 licensing agreements for UNL intellectual property. Most importantly, three new companies were launched or expanded by faculty based on their research inventions.

Historically, most UNL technologies were licensed to existing companies with the expertise and resources

expand their product lines. This approach remains important for moving university technology into the marketplace and generating revenue. But what excites Brasch most is the prospect of matching university technologies with entrepreneurs who create new enterprises that produce economic activity, good jobs and tax revenue in the Cornhusker State.

"We are eager to find opportunities that are good for the university, good for faculty inventors and good for Nebraska," he said.

Creating high-growth companies based on UNL technologies is a natural fit and central to tech development's dual aims of boosting Nebraska's economy and UNL's commercialization revenue, Brasch said. Highgrowth companies typically are technology-driven, focus on national or global markets, create high-paying jobs and, as the name implies, expand rapidly. They also tend to be entrepreneurial, higher risk and substantial money-makers, Brasch said. Examples include medical, biotechnology and software companies.

"Those are the types of businesses that can be seeded with the technologies available at universities. They are almost one and the same," he said.

#### Innovation hub

Paul said encouraging connections between university researchers and entrepreneurs is among UNL's long-term goals. University and Lincoln

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"We would like to create a hub that provides access to new technologies, supports development of new companies, and helps existing ones become

more competitive," Paul said. The payoff: business expansion and jobs for Nebraska and increased research and revenue for UNL.

The most successful innovation hubs are household names – North Carolina's Research Triangle and California's Silicon Valley. In both cases, universities have strong roles in a broader culture that supports discovery and risk-taking, he said.

This is a big dream, Paul said, but has enormous potential.

"If we succeed in helping to create new companies and more jobs, we can keep our talented people close to their families here in Nebraska and attract new people to our state. We want to be an economic driver that enhances opportunities in Nebraska," he said. An innovation hub also would enrich student learning and encourage the best faculty to come to or stay at UNL.

#### Potential and challenges

Brasch sees plenty of potential in UNL's portfolio of faculty inventions. The challenge is matching these inventions with the right business opportunities. To maximize chances of success, his team is strengthening connections with business and industry, pursuing commercialization agreements nationally and internationally, investigating financing options for startup companies, and scouting for experienced business people interested in investing in UNL technologies.

"A big part of our job is to focus on our most promising technologies, find people who would be interested, and convince them to make an investment," Brasch said.

Paul pointed out that UNL researchers already are helping address major challenges facing Nebraska and the nation.

"Our talented faculty are doing exciting work that's making a difference for Nebraska and the nation," he said. "The products of our research are top quality

– comparable to what's coming out of universities that are leaders in technology development."

Bolstering technology development will strengthen UNL's contributions. "That's good for Nebraska and its university," Paul said.

UNL's technology development transformation is in the early stages, but Brasch predicts significant long-term payoffs.

"We have tremendous support from our administration and we've built a foundation that is far more robust than anything in the past," Brasch said. "We're still a work in progress but we're making huge strides." 🌋

#### Brasch building on 'base hits'



Talk to anyone involved in university technology development and these well-known names come up – for good reason. Both are based on university research that morphed into huge commercial successes. They generate enormous payoffs and prestige for the universities where the ideas were born: the ubiquitous sports drink at Florida, the Internet search giant at Stanford.

UNL's John Brasch calls them tech development grand slams. He'd love a Husker homer, too, but he sees other paths to success.

"Everybody likes to think of the home run," he said, "but we'll build our momentum on base hits. Especially base hits within the Nebraska ball park."

Brasch leads UNL's tech development efforts with a vision of turning UNL technologies into new, high-growth businesses in Nebraska.

Brasch knows plenty about turning opportunities into thriving businesses. About 27 years ago, he left his job as a UNL business professor to pursue his entrepreneurial dreams. His resume includes founding and leading Senior Technologies Inc., now owned by Stanley, which designs and manufactures safety and security products for the health care industry. He's also CEO of Turun International Inc., an international holding company with European distribution operations.

"John's mix of business and academic experience makes him the right person to provide the leadership we need to meet our goals," said Vice Chancellor for Research Prem Paul.

For Brasch, returning to UNL is about turning possibilities into realities. To improve the chances of success, Brasch recently helped found the Nebraska Angels Inc., an independent group of investors with business experience and Nebraska ties who are interested in providing startup financing for new companies.

"We believe we can build business opportunities in Nebraska for people who want to stay as well as for those who want to come here or return home to enjoy our great quality of life."

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## Startup and spinoff successes

From nanomaterials and tiny surgical robots to innovative software and water-saving grasses for lawns, UNL discoveries and inventions are providing the seeds for entrepreneurial ventures as well as new products for existing companies.

UNL's expanded commitment to commercialize research discoveries emphasizes creating new companies that add jobs and boost Nebraska's economy. Recent examples include:



GC Image software provides twodimensional image processing for gas chromatography.

**GC Image** is a software company based on UNL technology. Founded in 2002 by computer science and engineering professor Stephen Reichenbach, whose expertise is in complex image analysis, this company has four employees. Through his research at UNL, he and colleagues developed the first software that provides complex, two-dimensional image processing for gas chromatography. This is important for analyzing complex chemical compounds such as petrochemicals. The university licensed this technology to GC Image, which sells the software commercially.

**LNKChemSolutions** is the only Lincoln area company<br/>focused solely on nanotechnology. Founded in 2000 by UNL<br/>chemical engineering professor Gustavo Larsen, the compa-<br/>ny began operating at the University of Nebraska's Technol-<br/>ogy Park in 2005. Its work is based partly on UNL-developed<br/>technologies. LNKChemSolutions focuses on nanoparticle<br/>and nanofiber research and development for a variety of<br/>applications, including toxicology, tissue engineering, encapsulation and<br/>controlled release. It has received contracts from the U.S. Department of<br/>Agriculture, the U.S. Department of Energy, the National Science Foun-

Agriculture, the U.S. Department of Energy, the National Science Foundation, the National Institutes of Health and Kraft Foods to develop new nanotechnology products for food, biomedical and other uses.

Nebraska Surgical Solutions Inc., a Nebraska-based startup company launched in 2006, is refining and commercializing miniature surgical robots developed through collaborative work by UNL and University of Nebraska Medical Center researchers. UNL mechanical engineer Shane Farritor and UNMC surgeon Dmitry Oleynikov and colleagues devised remotely controlled mini robots that can be inserted into the body to help perform minimally invasive surgery. The university owns the intellectual property on which this company is based. Nebraska Surgical Solutions was the first spinoff company to receive financial backing from the Nebraska Angels, a group of investors that provides critical startup capital for entrepreneurial companies.





Some earlier companies rooted in UNL research have become leaders in their product fields. For example:

J.A. Woollam Co. Inc. was established in 1987 by electrical engineering professor and physicist John Woollam and is based on his UNL research. The company designs and manufactures optics instruments called ellipsometers and is an international leader in spectroscopic ellipsometry, which measures thickness and other properties of thin films. The Lincoln company's analytical instruments are used primarily for research and development in universities and national laboratories and for product development in industry. Woollam employs more than 40 people – more than half of whom are scientists or engineers and UNL graduates. The company sells its hand-assembled instruments worldwide.

Rieke Metals Inc. is a Lincoln company that grew from technologies developed in the early 1990s by company founder Reuben Rieke, a UNL chemistry professor. He developed processes that produce highly reactive metal powders. In 1992, he started the company to further develop and commercialize a variety of products based on this technology. Today, Rieke Metals has 15 employees, sells its products worldwide, and is a leading global supplier of organic semiconducting polymers. The company recently partnered with BASF to commercialize highly flexible integrated circuits using Rieke's conductive polymer technology.



**Todd Valley Farms Inc.** produces turfgrass sod, seed and pre-rooted plugs. The company produces and sells several UNL-developed turf buffalograsses under university licensing agreements and works closely with the turf scientists who developed these grasses. The Mead, Neb., company sells the water-efficient buffalograsses nationwide and in several foreign countries. The company estimates that it has added six full-time and 15 seasonal employees thanks in part to its buffalograss sales, which are growing as homeowners, golf courses and municipalities recognize their environmental benefits. Todd Valley Farm's buffalograss sales increased more than 25 percent in 2006 compared with 2005.

## In the works

fully market them. For example:



While product development typically drives commercial researchers, university researchers thrive on expanding knowledge and understanding, exploring major problems, and finding innovative solutions. Discovery – not an end product – is the primary goal. Long-term basic research at universities generates discoveries that create the foundation for innovative products, new industries and advances that transform our world. Today's knowledge-driven economy, for example, is predicated on this basic research.

But the path to discovery also often leads to marketable inventions – novel technologies, processes or techniques. These are a few examples of the diverse and promising discoveries in UNL's research and development pipeline.

#### Fibers from the farm

Textile scientist Yiqi Yang is turning agricultural leftovers – cornhusks, rice straw and wheat gluten – into natural fibers for clothing and other potential uses.

Yang's team invented processes that convert cellulose from cornhusks and rice straw into fibers strong and long enough to be spun into yarn and



J.A. Woollam Co. designs and manufactures optics instruments called ellipsometers.

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Textile scientist Yiqi Yang invented processes that convert cornhusks, rice straw and wheat gluten into strong fibers for textiles, like this sweater made from cornhusks. woven into fabric using conventional textile machinery. The resulting fabrics are similar to cotton or linen. They've also produced high quality fibers similar to wool from the proteins in wheat gluten.

"We hope this research stimulates interest in using agricultural byproducts as textiles fibers," Yang said. "That would add value to agricultural crops and make the fiber industry more sustainable."

Fibers derived from Yang's process also have potential as building or packing materials and industrial fabrics. Whatever the use, fibers from low-cost, renewable and readily available farm byproducts could help replace fabrics or products made from petrochemicals.

Yang recently received Nebraska Research Initiative funding for equipment to advance this research. The university is patenting these processes and seeking investors interested in commercializing the fabrics. "If an

investor were identified tomorrow, we could get a product out in two years. We're ready," Yang said.

#### Novel cholesterol fighter

A novel compound made from Nebraska-grown ingredients is a promising cholesterol fighter.

Nutrition scientist Tim Carr discovered that combining stearic acid from beef tallow and sterols from soybeans creates a powerful cholesterol-lowering compound. The combination outperformed commercially available plant sterol food additives in animal studies, and preliminary results of a recent human study are promising.



Nutrition scientist

Tim Carr with his

novel cholesterol-

lowering

compound.

This compound significantly reduced LDL or "bad" cholesterol compared to a placebo, said Carr, who is still analyzing findings. The human study was funded through an agreement with Beef Products Inc., a South Dakota-based company with plants in Nebraska and three other states that is a leading producer of high-quality lean beef.

"I'm excited about the potential of this for consumers looking to manage their cholesterol," said Carr, who came up with the idea based on his research on fats' role in heart disease.

UNL is patenting Carr's invention and is exploring how best to commercialize it.

#### Better artificial bone

Chemist Jody Redepenning is building artificial bones that look and perform much like the real thing.

Redepenning discovered a simple process for making a biocomposite material that is as strong and flexible as bone. It can easily be molded into any shape to make so-called hard-tissue replacements. His process could be used to create bone replacements, implants, screws and other orthopedic, dental or medical devices.

During the healing process, the body will absorb the biocomposite material over time and redeposit it as living bone. "The idea is for it to go away," he said.

UNL is patenting Redepenning's process, which is simple, inexpensive and requires no toxic materials.

#### Other examples

• Chemist Steve DiMagno developed a new technology for preparing fluorinated drugs and imaging agents. The imaging agents are useful in

diagnosing various diseases, ranging from neurological disorders to cardiovascular problems. They could lead to new methods for PET scanning – a medical imaging technique – for early cancer detection.

• Engineer Yongfeng Lu devised a way to clean silicon wafers with a laser. Silicon wafers, used in the microprocessors that drive all sorts of technology tools, must be microscopically clean. Wafers currently are cleaned with isopropyl alcohol, which is flammable and toxic and adds to production costs. Lu's laser method thoroughly cleans the wafers, eliminating the need for alcohol and improving production efficiency.

• Chemist Gerard Harbison's research could lead to new tools for detecting bombs made from peroxide, a favorite material for terrorists. He's developing ways to use nuclear magnetic resonance machines to detect peroxide-based explosives. This research could lead to security screening equipment that rapidly checks for small amounts of these liquid explosives without touching or opening belongings.

### A few facts

CNL's inventions and innovations are commercialized through licensing and other agreements between the university and companies. Licensees typically pay royalties in exchange for the right to use the university's intellectual property. Earnings from these agreements help support UNL research. Office of Technology Development records show:

#### In the past decade

- Licensing and other agreements grossed nearly \$10 million for UNL, its departments and inventors.
- Technologies licensed to Nebraska companies resulted in about \$100 million in net sales revenue for these companies.
- More than 170 patents were issued for faculty inventions.
- More than 130 licensing agreements were signed.

#### Top net royalty generators 1997-2007

• Lignotech USA Inc., Rothschild, Wis., for cattle feed technology developed by animal scientist Terry Klopfenstein and Thomas Winowiski of Lignotech.

- LI-COR Inc., Lincoln, Neb., for DNA sequencing technology developed by
- biological scientist John Brumbaugh and Lyle Middendorf of LI-COR.
- Neogen Corp., Lansing, Mich., for food allergen detection tests developed by food scientists Susan Hefle and Steve Taylor.
- Monsanto Choice Genetics, St. Louis, Mo., for a highly productive swine line developed by animal scientist Rodger Johnson.

- Turfgrass America, Naples, Fla., for improved turf buffalograsses developed by turf scientist Terry Riordan.  $\clubsuit$ 

#### More information

Prem Paul has an invitation for anyone interested in UNL's technology development efforts: get involved.

"We want people involved in this vision we are trying to realize for Nebraska," the UNL vice chancellor for research said. Anyone interested in investing in UNL innovations, mentoring young entrepreneurs or learning more can contact the Office of Technology Development at (402) 472-1783, e-mail eurso2@unl.edu.

Or check out these Web sites:

- Office of Technology Development: http://www.unl.edu/research/td/td.shtml
- Office of Research:
- http://www.unl.edu/research/
- Nebraska Angels Inc., a group of independent investors interested in providing start-up financing and mentoring for entrepreneurs: http://www.nebraskaangels.org/home.php



Chemist Jody Redepenning's biocomposite bone material can be molded into bone replacements or orthopedic devices.

The Palladian Literary Society was founded in 1871 by 20 young men and five young women a month after the University of Nebraska opened its doors. Members gathered weekly for social and intellectual activities, including plays, orations, debates, recitations, music, promenades and refreshments. The group was active in one form or another until the late 1960s and alumni held a reunion as recently as 2000. In the beginning, meetings were held at University Hall, which featured a bell tower. Today, that same bell resides in the Holling Garden at the Wick Alummi Center.



Editor

Writer



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