In fall 2011 a group of business, law, and engineering students crowded into an observation room at Northwestern Memorial Hospital. As part of Northwestern’s NUvention: Medical Innovation course, the students had come on assignment to watch a minimally invasive—or laparoscopic—surgery, an operation performed with instruments and video cameras through a small incision in the patient’s body.

Laparoscopic surgery has benefits—reduced bleeding, less pain, and speedier recovery—but internal bleeding is a significant risk because surgeons must rely on tools to see what they are cutting. As the students watched the procedure on an operating room monitor, law student Jonathan Gunn leaned over to his classmates. “Why hasn’t anyone integrated blood vessel detection into surgical tools?” he asked.

It was the kind of “aha” moment that marks the start of a great venture—for those with the skills to bring it to life. At Northwestern, students gain that know-how in NUvention, a suite of experiential learning courses offered by the Farley Center for Entrepreneurship and Innovation. NUvention takes students from schools across the University, assigns them to multidisciplinary teams, and exposes them to the entire life cycle of a startup, from innovation to funding to execution. Faculty members, alumni, and entrepreneurs help students identify a problem, understand customer needs, and find a solution using “lean startup” methodology, which focuses on short business plans and minimal capital.

NUvention courses include Medical Innovation, Energy, Web, Innovate for Impact (in which students tackle unmet needs in resource-limited settings), and three recent additions: Digital Media, Nanotechnology, and Analytics. Some teams commercialize existing technology created in Northwestern labs; others develop their own products from scratch.

Since NUvention’s 2007 launch, 12 startups have gone on to become full-fledged money-making ventures, but not all outlive the one- or two-quarter courses. That’s okay, says McCormick Dean Julio M. Ottino, because starting companies isn’t the point. “Entrepreneurial skills are important for all McCormick students, not just those who envision a future in business,” says Ottino. “Today’s engineers cannot thrive without creativity, communication, and problem solving, all skills that are key to NUvention. And if the students happen to find a project that extends beyond the classroom, all the better.”
It took us a few iterations to realize that what investors really cared about was not how the technology works but how it performs and at what cost.”

JOSHUA LAU


PROBLEM: Mediocre lithium-ion battery performance
SOLUTION: SiNode Systems

When SiNode Systems took the stage in April at the 2013 Rice Business Plan Competition, the world’s richest and largest graduate-level business plan contest, team members showed the judges two photos. In the first, a sea of mourners gathered outside St. Peter’s Basilica in Rome following the 2005 death of Pope John Paul II. The second, shot during a papal speech in 2013, was almost identical—except nearly every person in the crowd was holding up a glowing smartphone.

SiNode’s message was clear. “We’re in the middle of a mobile revolution, and battery life is holding us back,” explained Cary Hayner, a PhD candidate in chemical and biological engineering and SiNode’s chief technology officer. “It is a problem that resonates with everybody.”

The pitch worked. SiNode won first place and more than $900,000, then went on to take top honors in the next stage of the contest, the second annual US Department of Energy National Clean Energy Business Plan Competition. (SiNode is the second student-led Northwestern startup in two years to win the DOE competition. NuMat Technologies, which designs high-performance materials for the safe and efficient storage of gases, won last year’s inaugural contest.)

Founded in 2011 in NUvention: Energy, SiNode commercializes battery technology developed in the lab of McCormick’s Harold Kung, Walter P. Murphy Professor of Chemical and Biological Engineering. For the past seven years, Kung has worked to create an electrode for lithium-ion batteries—rechargeable batteries such as those found in cellphones—that allows batteries to last for days and charge in minutes. The anodes are made of layers of silicon nanoparticles and graphene—an improvement over standard silicon-based anodes, which degrade quickly, causing the battery to weaken—that are pitted with tiny holes to allow lithium ions to enter the anodes more quickly, shortening the battery’s charging time.

When published in 2011, Kung’s research attracted the attention of media such as Forbes and Popular Science as well as battery companies and venture capitalists. But working with Northwestern’s Innovation and New Ventures Office—which manages invention disclosure, assessment, patenting, and marketing for Northwestern’s research discoveries—a NUvention: Energy team acquired the licensing rights.

The team assessed its finances, talked to customers about their needs, discussed the technology’s potential with energy experts, and developed a go-to-market strategy before entering its first competition in 2012, the Clean Energy Challenge, while its original nine members were still enrolled in the course. The technology got rave reviews, but the students’ delivery fell short. “Our pitch was too technical for our audience,” says Joshua Lau (MS materials science ’13), a SiNode research engineer and cofounder. “It took us a few iterations to realize that what investors really cared about was not how the technology works but how it performs and at what cost.”
Still, the judges’ positive feedback propelled them. When the course ended, a core group of five members—Lau and Thomas Yu from McCormick and Guy Peterson, Samir Mayekar, and Nishit Mehta from the Kellogg School of Management—brought on Hayner, who worked in Kung’s lab and had co-invented the technology. A startup wasn’t in Hayner’s plans, but he jumped at the chance. “I came to McCormick to work on renewable energy and sustainable science, so I was happy just working on the battery project,” he says. “Now to see my first research baby go beyond the lab is really exciting.”

SiNode still faces challenges. While $900,000 may sound like enough to catapult the company to commercial success, building a lab is extremely costly. The team plans to complete a seed funding round this fall—a feat that could be difficult in a particularly challenging clean-energy market. “Investors want to see something that can translate to the marketplace quickly,” says Hayner. “But this isn’t a web app, where you can make a billion dollars in a short few years. Clean tech is a long-term investment with much greater global impact and reward.”

“We saw a real opportunity to capture what students need in an app that allows you to type, draw, and annotate documents seamlessly.”

ALEX WILSON

As the creators of a note-taking application for mobile devices, Chisel team members (left to right) Amrit Kanesa-Thasan, Alex Wilson, and Samatha Zhang knew they faced steep competition. Even the team was surprised when 1,000 people downloaded their app in its first three days in the Apple Store. Not pictured: Westin Hatch.
computer science ’13) worked on programming; and Medill graduate student Samantha Zhang spearheaded design and marketing. They knew the shortcomings of the apps already on the market. Students they had interviewed had complained of disjointed apps with limited functionality; to write, draw, and import PDFs required several apps. “We saw a real opportunity to capture what students need in an all-in-one note-taking app that allows you to type, draw, and annotate documents seamlessly,” says Wilson.

After two months of development, the team launched Chisel in Apple’s App Store. Three days later the app ticked past 1,000 downloads, surpassing Chisel’s goal for the entire quarter. “We immediately started getting feedback from real users who were emailing us and asking for new features, many of which were already in the pipeline,” says Wilson. The tech blog App Advice praised the app, saying, “Chisel could be the only note-taking app you’ll ever need.”

While team members are still working out how to monetize Chisel—a premium version is available from the App Store for $9.99, but only a few users have sprung for it—they have received validation that they can compete in a crowded field. “Everyone shot down our idea at first, thinking it’d be too difficult. One classmate told me we were crazy,” says Hatch. “Then he finally saw the app, and he wanted to use it.”

• PROBLEM: Energy-consuming, quick-draining smartphones
• SOLUTION: MyPower

On most NUvention teams, dividing tasks is easy. Students take on the work that best suits them: law students handle intellectual property issues, business students raise funds, engineering students design. But when students in the winter 2013 NUvention: Energy course were given the opportunity to choose their teammates, Mike Geier, Tejas Shastry, and Alexander Smith—all PhD students in materials science and engineering—decided to team up.

What do three engineers do when asked to start a company? They learn how to start a company. “A lot of teams were more diverse than we were, but we were really interested in learning all the parts of entrepreneurship,” says Geier. “For us, NUvention was really a crash course in marketing and business strategies.”

They chose a concept: a wallet-sized device that attaches to a runner’s clothing and collects kinetic energy to power a smartphone. While similar devices had been developed for other uses—mainly for hikers or campers traveling to remote locations—the runners’ market was untapped.

Smith knew design software, so he became product designer. Shastry, perhaps the most business inclined, served as front man. And Geier had worked at a battery startup, so he spearheaded the device’s internal...
“One of SafeSnips’s major advantages is the ability not just to recognize blood vessels but to see where you can’t see.”

DAVID MAHVI

When they left the hospital’s observation room, the NUvention: Medical Innovation students had a great idea—but the hard work was just beginning. The first step: understanding the problem. By talking with surgeons from the Feinberg School of Medicine, the students learned that avoiding blood vessels is one of the biggest challenges in laparoscopic surgery. In open operations surgeons use their hands, allowing them to feel blood vessels pulsing, but with tools all tactile sensation is lost. Instead, surgeons must rely on their knowledge of anatomy, avoiding spots where arteries are known to be located in most patients. But bodies vary, and in surgery slight differences can be deadly: more than 3 percent of laparoscopic surgery patients experience unintended internal bleeding.

“That’s a significant number,” says Mayank Vijayvergia, a McCormick graduate student in biomedical engineering, “especially when you consider that in the United States, 18 percent of unintended bleeding incidents are fatal.

And patients who survive face hospital stays an average of nine days longer, as well as long-term complications.” Preventing unintended bleeding is also of interest to US hospitals, which spend billions of dollars to heal the injuries—an estimated $210,000 per patient, at the hospitals’ expense.

After much research and iterating, the students developed a promising solution: SafeSnips, blood vessel detection technology that can be integrated into existing laparoscopic cutting tools. As surgeons cut and cauterize, near-infrared spectroscopy sensors embedded in the tool’s tip identify the presence and diameter of nearby blood vessels. Alerts are sent to video monitors already in the operating room.

At the end of the two-quarter course, the team—now named BriteSeed—presented its business plan, complete with financials and a go-to-market strategy, to a panel of venture capitalists. The feedback was promising. “SafeSnips is a leap in technology,” says BriteSeed advisory board member David Mahvi, president of Northwestern

BriteSeed tackles the problem of internal bleeding in laparoscopic surgery with SafeSnips, blood vessel detection technology that can be integrated into existing surgical tools. The product has caught the interest of a Chicago incubator program, leading the team to pursue the company full-time.

PROBLEM: Internal bleeding in minimally invasive surgery

SOLUTION: SafeSnips

- PROBLEM: Internal bleeding in minimally invasive surgery
- SOLUTION: SafeSnips
Medical Group and chief of gastrointestinal and oncologic surgery at Feinberg. “One of its major advantages is the ability not just to recognize blood vessels but to see where you can’t see. My hope is that BriteSeed’s technology, which is initially used to detect bleeding, could eventually be used to see other things.”

After the course ended, the nine-member BriteSeed team slimmed down to a core of four cofounders representing three Northwestern schools: Vijayvergia from McCormick, medical student Paul Fehrenbacher, and from the Law School, Gunn and 2012 graduate Muneeb Bokhari. Mahvi and Hariharan Subramanian, an alumnus of McCormick’s biomedical engineering program and a research professor in the lab of biomedical engineering professor Vadim Backman, joined as consultants.

In June 2012 BriteSeed scored its first major success: first place—and more than $100,000 in cash and prizes—in the 2012 TechWeek Launch competition. Four months later the startup was named “Up-and-Comers” at the 2012 Chicago Innovation Awards, and in April at the 2013 Rice Business Plan Competition it was named Best Life Science Team, taking home more than $273,000 in winnings.

Today BriteSeed’s home is Insight, a product development firm on Chicago’s North Side that has designed products for such Fortune 500 companies as Baxter and St. Jude Medical. Among Insight’s specialties are medical devices, including the cutting tools used in minimally invasive surgeries, so BriteSeed is a natural fit as the first startup in the Insight Accelerator Lab’s 18-month program. Vijayvergia, Gunn, and Fehrenbacher have put their graduate studies on hold to pursue the business full-time. “Several of us are a little older and have families, so there is a lot at stake,” says Fehrenbacher. “We think it is worth the risk.”

Sarah Ostman