DEPARTMENT OF
Electrical and Computer Engineering
UNIVERSITY OF WISCONSIN–MADISON

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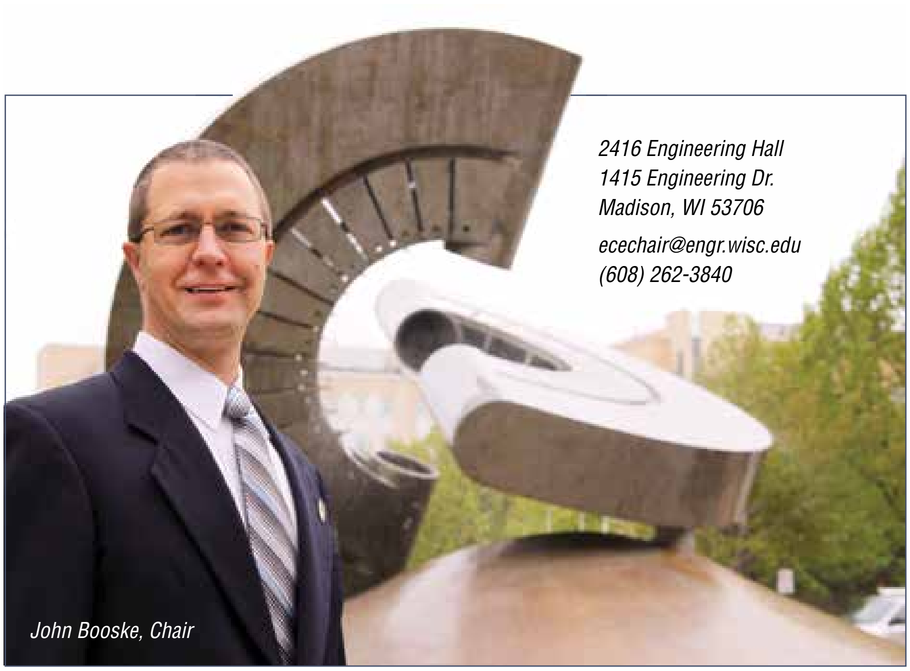
FOCUS ON INNOVATION



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John Booske, Chair

What an exciting and productive year we've had in your UW-Madison electrical and computer engineering department! As always, the key to our success has been focus. Our mission remains focused on a world-class education for our students, and a world-class faculty who lead the nation in education and research.

To achieve that world-class education, we have focused on being at the nation's forefront, combining both state-of-the-art teaching methods—including blended learning, flipped classrooms, and remote access via online sections—with innovative instructional spaces that optimize the effects of the new teaching methods. Our coveted electrical engineering and computer engineering graduates are among the nation's best-educated engineers, as our many enthusiastic recruiters confirm, year after year. Particular highlights this past year include the naming of the new Plexus Active Learning Lab, the incredibly successful Qualcomm Innovation Prize competition experience, and the recognition of one of our faculty with the IEEE's highest honor for national education innovation leadership: the 2014 IEEE Educational Activities Board Major Education Innovation Award. In addition, UW-Madison acknowledged our department's leadership in education innovation by inviting me to be the featured faculty speaker at this fall's Chancellor's Convocation for new students.

Our students continue to garner accolades for exceptional learning, achievement and innovation. ECE students have been selected as finalists in the U.S. Patent Office's National Inventors' Competition and the NASA National Robo-ops robotics competition, won the Desire2Learn national Edge Challenge Grand Prize, and co-authored the best paper award at the International Conference on VLSI Design.

Meanwhile, our world-class faculty have focused on national and global leadership in areas critical to humankind's future: power and energy, digital information, and human health. Fundamental research breakthroughs have included developing the world's first transparent optogenetic brain implants that promise to revolutionize brain research; developing a new artificial compound "lobster" eye that may revolutionize medical, astronomical and national defense technologies; and developing algorithms that convert massive (big) data sets into useful information for understanding the brain, improved medical imaging or advanced manufacturing.

Translational and applied research breakthroughs have included developing microwave ablation technologies for operating on brain and breast tumors, developing revolutionary motors that don't require rare-earth metals, and designing microgrids, electric vehicles, wireless networks, and energy-efficient microprocessors that provide exceptional performance with significantly reduced energy consumption.

Our department is closely involved in launching the exciting new Grainger Institute for Engineering that will yield transformative, cross-disciplinary breakthroughs in advanced manufacturing and materials. The excellence of our faculty and their leadership contributions continues to be recognized by the campus, state and the nation. Professor Rob Nowak received the prestigious UW-Madison Kellett Mid-Career Award. Professor Dan van der Weide was part of a team winning the 2014 Wisconsin Governor's Business Plan Contest. Professors Susan Hagness, Nader Behdad, Parmesh Ramanathan and Kewal Saluja won best paper awards at major international conferences. Professor Nowak was honored with the prestigious 2014 IEEE W.R.G. Baker Award for a seminal 2009 paper on harnessing sparsity. And Professor Bob Barmish was recognized in December 2013 for seminal lifetime contributions to control systems engineering with the IEEE Control Systems Society's top honor: the Hendrik W. Bode Lecture Prize.

How is all of this possible? The answer is with dedicated, exceptional faculty and students, supportive and visionary college leadership, and the increasingly generous support of our loyal alumni and corporate sponsors. Your gifts benefit students by funding the transformation of courses into superior blended-learning experiences and community-building events. Without those gifts we would be hampered in hiring and retaining our world-class faculty. In short, these gifts are critical to sustaining the exceptional value of your department's brand. The brand that says a UW-Madison ECE degree means exceptional world-class engineering leadership. Today and forever. On Wisconsin!

Duane H. & Dorothy M. Bluemke
Professor John Booske, Chair

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See-through sensors open new window into the brain

Jack Ma

Developing invisible implantable medical sensor arrays, a team of UW-Madison engineers has overcome a major technological hurdle in researchers' efforts to understand the brain.

The team described its technology —which has applications in fields ranging from neuroscience to cardiac care and even contact lenses—in the Oct. 20, 2014, issue of the online journal *Nature Communications*.

Neural researchers study, monitor or control the brain using imaging techniques in conjunction with implantable sensors that allow them to continuously capture and associate fleeting brain signals with the brain activity they can see. However, it's difficult to see brain activity when there are sensors blocking the view.

"One of the holy grails of neural implant technology is that we'd really like to have an implant device that doesn't interfere with any of the traditional imaging diagnostics," says Justin Williams, the Vilas Distinguished Achievement Professor of biomedical engineering and neurological surgery at UW-Madison. "A traditional implant looks like a square of dots, and you can't see anything under it. We wanted to make a transparent electronic device."

The researchers chose graphene, a material gaining wider use in everything from solar cells to electronics, because of its versatility and biocompatibility. And in fact, they can make their sensors incredibly flexible and transparent because the electronic circuit elements are only 4 atoms thick—an astounding thinness made possible by graphene's excellent conductive properties. "It's got to be very thin and robust to survive in the body," says Lynn H. Matthias Professor and Vilas Distinguished Achievement Professor Zhenqiang (Jack) Ma. "It is soft and flexible, and a good tradeoff between transparency, strength and conductivity."

Drawing on his expertise in developing revolutionary flexible electronics, he, Williams and their students designed and fabricated the micro-electrode arrays, which—unlike existing devices—work in tandem with a range of imaging technologies. "Other implantable micro-devices might be transparent at one wavelength, but not at others, or they lose their properties," says Ma. "Our devices are transparent across a large spectrum—all the way from ultraviolet to deep infrared. We've even implanted them and you cannot find them in an MR scan."

> "Our devices are transparent across a large spectrum—all the way from ultraviolet to deep infrared. We've even implanted them and you cannot find them in an MR scan."
> —Professor Zhenqiang (Jack) Ma—

The transparent sensors could be a boon to neuromodulation therapies, which physicians increasingly are using to control symptoms, restore function, and relieve pain in patients with diseases or disorders such as hypertension, epilepsy, Parkinson's disease, or others, says Kip Ludwig, a program director for the National Institutes of Health neural engineering research efforts. "Despite remarkable improvements seen in neuromodulation clinical trials for such diseases, our understanding of how these therapies work—and therefore our ability to improve existing or identify new therapies—is rudimentary."

Currently, he says, researchers are limited in their ability to directly observe how the body generates electrical signals, as well as how it reacts to externally generated electrical signals. "Clear electrodes in combination with recent technological advances in optogenetics and optical voltage probes will enable researchers to isolate those biological mechanisms. This fundamental knowledge could be catalytic in dramatically improving existing neuromodulation therapies and identifying new therapies."

The advance aligns with bold goals set forth in President Barack Obama's BRAIN (Brain Research through Advancing Innovative Neurotechnologies) Initiative. Obama announced the initiative in April 2013 as an effort to spur innovations that can revolutionize understanding of the brain and unlock ways to prevent, treat or cure such disorders as Alzheimer's and Parkinson's disease, post-traumatic stress disorder, epilepsy, traumatic brain injury, and others.

While the team centered its efforts around neural research, they already have started to explore other medical device applications. For example, working with researchers at the University of Illinois-Chicago, they prototyped a contact lens instrumented with dozens of invisible sensors to detect injury to the retina; the UIC team is exploring applications such as early diagnosis of glaucoma.

Additional authors on the *Nature Communications* paper include UW-Madison ECE graduate students Dong-Wook Park and Solomon Mikael, materials science graduate student Amelia Schendel, biomedical engineering research specialist Sarah Brodnick; biomedical engineering graduate students Thomas Richner, Jared Ness and Mohammed Hayat; collaborators Farid Atry, Seth Frye and Ramin Pashaie of the University of Wisconsin-Milwaukee, and Sanitta Thongpang of Mahidol University in Bangkok, Thailand.

The researchers are patenting their technology through the Wisconsin Alumni Research Foundation (WARF). Funding for the research came from the U.S. Defense Advanced Research Projects Agency, the National Institutes of Health, and the U.S. Office of Naval Research.

Novel antenna breaks down barrier in tumor ablation technology

Philip Dunham Reed Professor Susan Hagness and Associate Professor Nader Behdad had not considered challenging a commonly held idea about tumor ablation technology until their conversations with a UW-Madison neurosurgeon prompted them to seek less invasive therapies for cancer patients. Hagness and Behdad were familiar with the argument that microwave ablation systems should use relatively low-frequency microwave radiation to destroy cancerous cells, because lower frequency microwaves can penetrate deeper into human tissue and create a larger ablation zone.

Microwave ablation uses an antenna inserted into tissue to deliver electromagnetic energy to cancerous tumors, essentially heating up and killing the malignant cells. And the larger the antenna size, the lower frequency it produces. In other words, ablation antennas that are designed to operate at lower frequencies tend to be relatively large.

So Joshua Medow, a UW-Madison assistant professor of neurosurgery, asked Hagness and Behdad if they could develop a less invasive approach to thermal therapies. The two engineers first ran some simulations to learn more about the limitations of higher frequency microwave ablation—and, contrary to popular belief, they discovered that high-frequency microwaves offer a comparable ablation area.

"Those initial discussions with Joshua really pushed us to look at higher frequencies," Hagness says.

Medow's interest in creating a less invasive way to treat brain tumors grew out of a personal experience. While a resident at UW-Madison, he watched one of his instructors, neurosurgeon John A. Sandin, battle a brain tumor of his own. Sandin died in 2008, but Medow remained inspired by their conversations. "When I was talking with John, I thought there has to be a better way than taking somebody's head apart," Medow says.

> The researchers are using this new knowledge to design smaller ablation antennas that can reach tumor sites through less invasive means.

Now, with a $390,000 grant from the National Science Foundation and technology accelerator funding from the Wisconsin Alumni Research Foundation, as well as licensing support, the three researchers are using this new knowledge to design smaller ablation antennas that can reach tumor sites through less invasive means.

"If we can design the antenna to be small enough to route around bends, we open up a whole new realm of treatment possibilities. And when we go to higher frequencies, we can design the antennas to be shorter in length," Hagness says.

She, Behdad, whose research focuses on antenna design, and their PhD student, Hung Luyen, discovered they could make the antennas not only shorter, but narrower, by eliminating a bulky component called a balun. In antenna technology, baluns take many forms to control the flow of current and to convert balanced signals to unbalanced signals. In an ablation context, baluns help to ensure that currents don't run on the outer surface of the feeding cable of the antenna and don't heat up and damage the healthy tissue along its insertion path. But the research team demonstrated that operating the antennas at a different resonant frequency creates a natural choke point that controls the current without the need for a balun. In tests on *ex vivo* cow livers, this new design has created ablation zones comparable to those created with conventional ablation antennas.

A truly miniaturized antenna—both shorter and narrower than conventional ablation antennas but offering the same ablation capabilities—creates two important opportunities for cancer treatment. First, surgeons could bring the antenna to the tumor site by routing a catheter through a patient's circulatory system, which is far less invasive than delivering the ablation probe through open surgery or laparoscopic surgery.

Additionally, surgeons could use not just one small antenna but possibly arrays of small antennas to customize ablation to treat specific kinds of cancers and address the needs of specific patients. "Tumor shapes are not necessarily similar to the ablation heating pattern, so sometimes you need nonconventional heating patterns," Behdad says.

In addition to developing new ablation systems around the new miniature antennas, the researchers are exploring ways to incorporate the new antennas into existing systems to make them less bulky. Medow says

(Continued on back page)

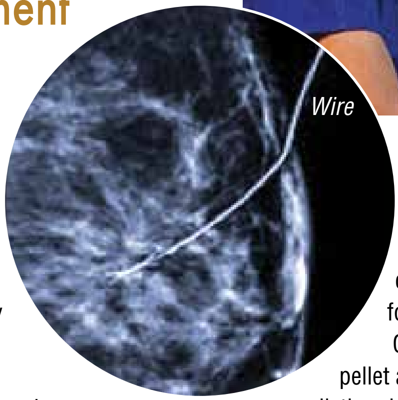
From left: Madison West High School junior and summer research intern Suzanne O'Meara, Nader Behdad, Susan Hagness, and PhD student Hung Luyen.

Breast cancer may inspire more public discussion, advocacy and charitable giving than almost any other disease besides HIV and AIDS. But people rarely talk about the specific experiences to which cancer patients are subjected.

Especially the localization wire.

Even on the website of the Susan G. Komen Foundation, the most prominent international voice of breast-cancer awareness, the device is seldom mentioned.

Elucent tracks down improvement in breast-cancer treatment



At left: an X-ray of the localization wire typically used in breast-tumor removal. Above, Dan van der Weide and Fred Lee *(Photo: Michael Kienitz)***.**

A localization wire literally is a thin wire inserted into the breast through a needle to help mark the location of a tumor or benign mass on the day of surgery. For the patient, it's one more step in an already painful and emotionally agonizing process.

And for a group of UW-Madison engineers and clinicians, it was an opportunity to develop a solution that is technologically elegant, precise and patient-centric.

The team's solution—a system that replaces the localization wire with a radio-frequency tag that helps the surgeon track the tumor's location with greater precision—was the impetus for the researchers to found the company Elucent. The company's proposal—which aims to benefit patients and care providers alike—recently won the 2014 Wisconsin Governor's Business Plan Competition.

Elucent's founding team draws on past successes with medical-engineering collaborations. Dan van der Weide, a UW-Madison professor of electrical and computer engineering, Fred Lee, a radiology professor, and Chris Brace, an associate professor of biomedical engineering and radiology, previously have worked together to advance technology for tumor ablation, founding the company NeuWave Medical in the process. Former NeuWave CEO Laura King now heads up Elucent. Elucent also boasts Elizabeth Burnside, a UW-Madison associate professor of radiology and industrial and systems engineering, and Lee Wilke, director of the UW Health Breast Center and a UW-Madison professor of surgery, who also researches novel treatments for breast cancer.

Van der Weide discusses the localization wire with palpable dismay. "It's not something I think I would wish on anyone," he says. "It's stressful to place this wire on the day of a difficult surgery."

And to an engineer's eye, the localization wire creates all kinds of obstacles to the end goals of removing a tumor while preserving as much healthy breast tissue as possible. For example, the wire is inserted when the breast is compressed in a mammogram machine or under ultrasound guidance. If the mass or cancer is in the center of the breast, there may be a distance of more than 2 inches from that mass to the skin where the wire must exit. "I get a 2D picture of where the wire is in the breast, but it's a 3D event—and requires piecing the pictures together to find the cancer," Wilke says.

Even at best, the localization wire is simply marking one point along the boundary of the tumor—leaving it to the surgeon to figure out the rest of the picture. "The wire can be very biased, because it only comes from one direction," Wilke says. "It's been this way for more than 30 years."

One possible workaround is to implant a small radioactive pellet at the location of the tumor, then track it with a handheld radiation detector. But Wilke points out that cancer clinicians are already exposed to a lot of radiation, and putting them at even more risk obviously isn't good for anyone.

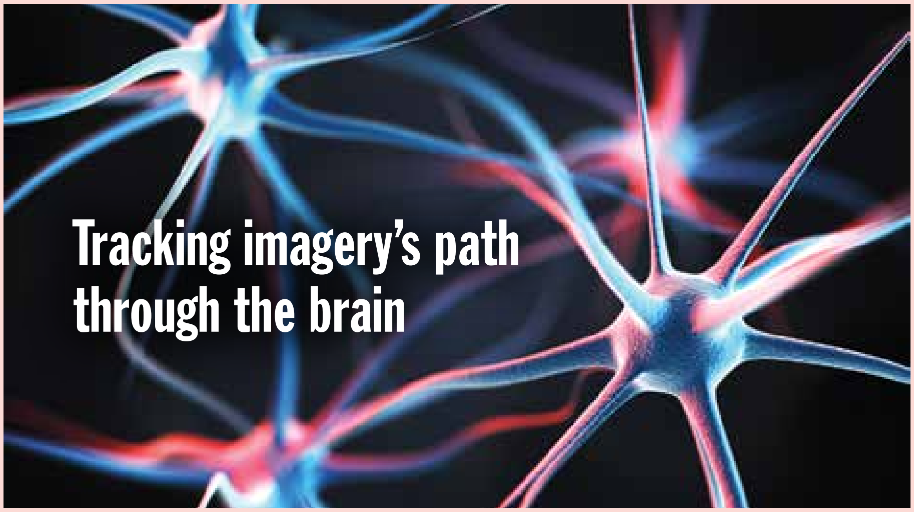
Radio frequency identification (RFID), a widespread technology with many applications in tracking and communication, offers a compromise.

The solution depends on expanding the scope of a relatively simple technology with many everyday uses. A pet that's been "microchipped" has been implanted with an integrated circuit that uses RFID technology to transmit identifying information when scanned. One of Elucent's main technical challenges is to create a new kind of RFID tag that will better adapt the technology to localization purposes. "There's no facility for saying, look, the tag is exactly 3.5 cm deep and over 1 cm from where your reader is," van der Weide says.

He currently is working on designing a coil array that can wrap around an RFID tag and provide more precise location data via a wand-like reader in the operating room.

Surgeons like Wilke would welcome a viable alternative to the localization wire, provided it is easy to learn and use—and van der Weide takes pride in the fact that Elucent's solution to the problem isn't really all that complex. In fact, the company's big pitch is that it makes the treatment process cheaper and logistically simpler. Because the tag could be implanted while the patient undergoes a biopsy, it essentially eliminates not only the wire but also the entire localization wire-implant procedure, which the company says can save up to $2,500 per patient.

Before Elucent can replace the localization wire with what's essentially a small metal pellet, the engineers will refine the object's design and seek regulatory approval. But the team is confident that stepping back and re-thinking an outdated procedure will elevate the standards of care and dignity for breast-cancer patients. "A lot of medical procedures evolved out of an immediate need and common sense and simplicity weren't at the forefront," van der Weide says.



Tracking imagery's path through the brain

UW-Madison researchers are using a combination of neuroscience and sophisticated data analysis to explore the brain's behavior as a network. Lynn H. Matthias Professor Barry Van Veen and his collaborators are interested in analyzing the nuances of cognitive activity that involves more than one area of the brain working together.

"A really important problem in current brain research is understanding how different parts of the brain are functionally connected. What areas are interacting? What is the direction of communication?" Van Veen says. "We know that the brain does not function as a set of independent areas, but as a network of specialized areas that collaborate."

Van Veen

Van Veen cautions that it is difficult to prove the effectiveness of new techniques for measuring these types of interactions. When it comes to many questions about processes at work in the brain, there's often no objectively established truth against which to measure experimental results. Additionally, measured EEG data (electrical activity measured on subjects' scalps that indicates underlying brain activity) includes plenty of noise—that is, brain activity not necessarily related to the particular process researchers want to study. But by focusing on the differences between tasks—such as watching video and daydreaming—researchers have a better chance of identifying important attributes.

Van Veen spent the past few years collaborating with colleagues in the UW-Madison psychiatry department to test whether imagined visual scenes and visual information received through the eye have different network signatures in the brain. In a paper published October 15, 2014, in *NeuroImage,* the researchers presented evidence that the flow of information between regions of the parietal and occipital lobes—areas of the brain known to be involved in both perception and imagery—changes significantly between visual perception and imagination.

During imagination, the researchers found an increase in "top-down" flow of information—that is, from parietal to occipital lobes—suggesting the imagery may be generated by higher-order regions of the cortex. In contrast, perception through the eyes is known to originate in the occipital lobe and then travel bottom-up to higher order areas of the brain.

For Van Veen, an important aspect of the research was demonstrating the effectiveness of a set of data analysis tools. "We were very interested in seeing if our signal-processing methods were sensitive enough to discriminate between these conditions," Van Veen says. "These types of demonstrations are important for gaining confidence in new tools."

In this case, the tool was an algorithm Van Veen and his collaborators developed for analyzing EEG signals. Subjects in the study donned a net of electrodes and experienced sessions of both visual imagery and imagined imagery. In one session, participants watched short clips from the *Sims3* video game, and were then asked to replay them mentally. In another session, subjects were asked to daydream about traveling on a magic bike, then watch a short video of silent naturalistic scenes. The results suggest that the brain indeed handles seen and imagined imagery very differently.

Giulio Tononi, a UW-Madison psychiatrist and neuroscientist who co-authored the study, points out it's the first time scientists have directly demonstrated this particular contrast.

"As simple as it is, it was never translated into a precise scientific hypothesis," Tononi says. "There seems to be a lot in our brains and animal brains that is directional, that neural signals move in a particular direction, then stop, and start somewhere else. I think this is really a new theme that had not been explored."

The researchers say their tools could advance the study of mental and neurological disorders. Tracking the flow of information has implications for understanding and perhaps treating the symptoms that schizophrenia patients experience, Van Veen says. He also is currently working on applying this study's methods to working memory experiments, to better understand how the brain uses networks to encode short-term memory.

As an engineer with a background in signal processing, Van Veen is wary of jumping to conclusions about biological processes. But he's encouraged to see EEG data that highlights the complex relationships between different areas of the brain.

"My goal has been to develop a tool that can be used to help understand how the brain is functioning," Van Veen says. "We want to make sure the tool is working—it's giving a sensible answer, as best as we can tell. This particular paper demonstrates we're able to see some interesting effects that hadn't been seen before."

PLEXUS COLLABORATORY:

When UW-Madison pursues big changes in teaching methods, students have a better chance at succeeding in the real world. Where professors see flipped course models and flexible classroom spaces, employers see more under-graduates picking up communication and collaboration skills that often prove just as important as the technical foundations of engineering.

That's why Plexus, a Neenah-based company that provides a wide range of electronics design and manufacturing services, contributed $200,000 to support a new learning space in Engineering Hall. The Plexus Collaboratory will give students an open, collaborative environment that breaks down the barriers between classroom and lab. While the lab's workstations will provide an array of advanced technical capacities for instruction and design projects, its layout will serve the innovative course structures in which the department is a national leader. "Flipped" or "blended" courses shift class time away from

Undergrad finds his passion by jumping into the deep end

When Arjun Seshadri decided to study engineering, he wasn't necessarily thinking about medical applications. That changed when he discovered the UW-Madison Lab for Molecular Scale Engineering. Before his freshman year was over, he became a research assistant in the lab under former ECE Professor Robert Blick and his graduate students.

Currently a senior, Seshadri found his passion in the development of a device that uses radio waves to measure the activity of proteins in cell membranes. The technology, described in a 2013 paper in *Soft Nanoscience Letters,* offers an improvement on current methods with application areas including DNA sequencing and understanding ion channels, proteins that play an essential role in cell regulation and communication. The device could potentially also be used to detect cancerous cells in blood.

"It was only when I ran into this stuff that I realized I wanted to do work that could make an impact, that others would pay attention to," Seshadri says. "This project was a great way for electrical engineering concepts to be applied in a sense that was very directly relevant to real people."

Current techniques for ion channel research use direct current to measure, say, how a specific protein reacts to a change in voltage or the introduction of a given chemical. The Blick group's device instead uses radio frequencies, which could enable a more detailed and more real-time analysis.

"The advantage to our setup is that you can detect things very quickly, because we're working on radio frequencies around 250 MHz," Seshadri says.

Abhishek Bhat, a grad student and lead author of the 2013 paper, says the group aims to analyze ion channel activity at a nanosecond time scale. "In simple terms, we should be able to reliably sequence over 100 million DNA bases every second," Bhat says. "The current record stands at just about 1 million."

Realizing those ambitious time-domain goals is Seshadri's focus as the group prepares to submit another paper. The group's published research so far shows experimental successes in the frequency domain. Seshadri is also beginning to work with a company in San Diego that might adapt the technology for DNA sequencing. The device could eventually impact medical research on a much broader scale, though, especially when it comes to studying ion channels.

"Ion channels are the basic communication and regulation means for cells," Bhat says. "The heart beats due to these channels firing; all neurons communicate via these channels; touch, hearing and all senses are governed at a cellular level by these channels. There are quite a few illnesses that occur due to the channels not functioning correctly. This makes the channels extremely important for study, especially for pharmaceutical applications."

Seshadri says that doing graduate-level research in his freshman year took dedication and a welcoming group of mentors. "Being a freshman, I barely knew circuits, so a lot of the work I had to do was just taking a textbook, taking three days off and going to the basement of Engineering Hall and just reading," he says. "The group was really accepting of the fact that I initially didn't know a lot, and they pointed me in the right direction to learn and catch up. I got to do a lot of learning in a very short period of time."

The next step in UW-Madison engineering educational innovation

lectures and into hands-on projects where students benefit from increased interactions with their instructors, and reinforce what they learn by helping to teach each other. "The way they're setting up the curriculum is enforcing a bit more mastery, and it's more real-world," says Mike Running, an ECE alum who now serves as Plexus' vice president of global engineering operations. "It's less textbook and more hands-on. I think it's focused on the right overall skills."

Running says it's important for students to emerge from school with what he calls "soft skills" like teamwork and mentoring to back up their understanding of engineering concepts. The flexibility of the new space, he says, creates more opportunities for students to develop those skills as an integral part of their education. "Plexus has seven design centers globally. On almost all of our projects, engineers are not just doing work with the person in the cube next to them, they're working with people around the world," Running says. "Being able to coach other people, that mentoring aspect, is one of the most critical things that we're looking for in upper-level engineers."

Duane H. & Dorothy M. Bluemke Professor and ECE Chair John Booske says the gift from Plexus will power a big step forward in the department's long-running pursuit of better educational models.

"The innovative Plexus Collaboratory builds on active and blended learning space concepts pioneered on this campus, but now extends them to hands-on instructional labs, not just conventional concept and theory courses," Booske says. "Its 92-seat capacity—unprecedented for an instructional laboratory classroom—enables every student to simultaneously learn from an experienced faculty member, expert teaching assistants and their peers, while having access to a full complement of individual and collaborative instructional and laboratory technology resources."

The larger vision Booske articulates when it comes to pushing education forward is a big part of why Plexus decided to support the new space.

"From my standpoint, there's thought leadership that's going on at UW-Madison," Running says. "They've been very forward-thinking in terms of getting it implemented. You hear about good ideas, but the team here is really making it happen."

Tumor ablation technology

(Continued from page 4)

he'd like to collaborate with the UW-Madison School of Veterinary Medicine and use the new technology to treat animals with cancers that normally can't be treated.

As part of the NSF grant, the researchers are also creating outreach programs for female middle- and high-school students interested in engineering. Each year, a Madison Metropolitan School District high-school student will participate in a summer research internship in Hagness's and Behdad's lab, and the researchers will also be offering a one-day workshop for middle-school girls on engineering new cancer treatment technologies. Hagness, whose research has focused extensively on applying electromagnetics to medicine, hopes it will give future female engineers a better sense for how the different engineering disciplines can be put to altruistic use.

In this case, two electrical engineers—encouraged by a surgeon—investigated an important medical technology at a fundamental electromagnetics level and opened up a whole new range of possibilities for improving treatment.

"We're planning a very systematic study of the physics of ablation over a wide parameter space, and we're going to look at a variety of other novel antenna designs," Hagness says.

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UNIVERSITY OF WISCONSIN–MADISON

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Alum honored at ENGINEERS' DAY 2014

Winslow Sargeant received a College of Engineering award during the ENGINEERS' DAY celebration on Oct. 24 on the UW-Madison campus.

Distinguished Achievement Award

Winslow Sargeant
PhDECE '05

Doing graduate research on fiber-optics and optical detection as a UW-Madison PhD student turned out to be surprisingly good preparation for Winslow Sargeant in his current role as chief counsel for advocacy for the U.S. Small Business Administration's Office of Advocacy. Sargeant leads an office that serves as an independent voice for small business before Congress and federal agencies and the White House. "One can liken my PhD research to what I do now—I try to extract the signal from the noise," he says.

Originally nominated by U.S. President Barack Obama in May 2009, Sargeant received a recess appointment in August 2010 after the U.S. Senate failed to give him an up or down vote. He was unanimously confirmed by the full Senate in November 2011.

Sargeant earned his UW-Madison PhD in electrical and computer engineering in 1995, and two years later co-founded AANetcom, a company that designed computer circuit technology for telecom and broadband applications, including technology for which he earned a U.S. patent. Sargeant and his co-founders sold the company in 2000 to PMC-Sierra, a publicly traded company.

After that, Sargeant spent four years at the National Science Foundation (NSF), working at the intersection of business, research and government as the program manager for the Small Business Innovation Research Program in Electronics. He was proud to serve an organization that had funded his own graduate research at UW-Madison. His next step was to deepen his experience in the business world, serving as the managing director at Venture Investors, a Madison firm that invested in new healthcare and IT startups.

When Sargeant began his current role at the Small Business Administration, Sargeant brought to it a variety of experience in business and government, and the interaction between the two. The biggest challenge of the job, he says, is that his office is an independent entity within the executive branch, charged not to represent the administration—but rather, small business in general, especially when it comes to understanding how laws and regulations will affect business.

His career earned him the first UW-Madison Distinguished Young Alumni Award in 2002, while still at the NSF. He also has received the NSF Director Award for Program Management Excellence, was inducted into Sigma Xi, was named a Kauffman fellow in 2011, and is a former member of New York Academy of Sciences.

Sargeant lives in northern Virginia with his wife, Ikanyeng (also a UW-Madison graduate), and their three children, Kgosi, Lorato and Marang. His hobbies include coaching little league basketball, computer programming and electronics, and geography.