Dear Alumni, Colleagues and Friends,

The dividing line between medicine and engineering continues to blur, as engineers now routinely work side-by-side with physicians to develop new drugs, devices and procedures to diagnose and treat a variety of diseases and ailments. The Greater Lowell area, especially Cambridge, is a leader in this movement, with research hospitals, drug makers and universities forming a “Life Sciences Hub.” Simultaneously, the area immediately surrounding Lowell has become a hub for medical devices, with large firms such as BD, Boston Scientific, General Electric, Johnson & Johnson, Medtronic, Philips, Siemens and Smith & Nephew, to name a few, having significant local facilities.

Furthermore, UMass Lowell has become a center for smaller medical device firms through its vibrant incubator, the Massachusetts Medical Device Development Center, or M2D2. The center, which runs in conjunction with UMass Medical School in Worcester, provides engineering, business, medical and clinical trial support to more than 50 companies, housed in nearly 20,000 square feet of space at Wannamoisett Mills and 110 Canal Street in Lowell. Thus, there is significant demand for talent in this area, especially locally.

To support this industry need, we are proud to announce the launch of our new undergraduate bachelor’s degree program in biomedical engineering (BME), with a focus on the design and manufacture of medical devices (see the facing page). The first class of 42 students is of the highest quality, with the highest average high school GPA of any incoming major at the university and second-highest average SAT score. The program was designed with a number of external partners such that in addition to traditional course and lab work, students will have rich experiences outside of the classroom, whether at leading medical device manufacturers, small startups sponsored by M2D2 or research experiences at UMass Lowell or UMass Medical School.

In addition to providing a future workforce, the program will also feed our successful biomedical engineering and biotechnology program, which offers master’s and Ph.D. degrees across the University System. The BME lab courses will ultimately be delivered in Perry Hall, which will soon undergo major renovation.

Along with our increase in academic programs, we have hired a number of new faculty members working in the highly-defined field of biomedical engineering. Read on to learn more about our work in medical imaging, innovative drug delivery systems and new materials with medical applications. We have also increased our student’s interest in science and engineering and new curricula in our existing programs. We are pleased to see that the state of Massachusetts is a leader in the development of medical devices; the state’s emphasis on medical device manufacturing is well ahead of leading states, which are only now recognizing this new industry. The state of Massachusetts is a leader in the development of medical devices; the state’s emphasis on medical device manufacturing is well ahead of leading states, which are only now recognizing this new industry. The state of Massachusetts is a leader in the development of medical devices; the state’s emphasis on medical device manufacturing is well ahead of leading states, which are only now recognizing this new industry.

The four-year program is designed to prepare students to enter the workforce for designing and manufacturing medical devices while complementing other statewide efforts in bioengineering, which currently serve the pharmaceutical and biopharmaceutical industries, "says plastics engineering Prof. Stephen McCarthy, the program’s director (see page 13). It will also complement the graduate degree programs in biomedical engineering and biotechnol- ogy (B8E8T) being offered jointly by UMass cam- puses at Boston, Dartmouth, Lowell and Worcester.

The CLASS OF 2020

We have a total of 42 freshmen enrolled in BME; this semester, most of them from the 2016 freshman class is female." He adds: "They are exceptional students—top in their classes and very enthusiastic about medical devices."

I chose the biomedical engineering program because "like biology and engineering, I am a [freshman] Joaquin Cote. "We’ve been learning Sphero links, which is the program we use to make computer-designed devices. I have a strong interest in biotech, biophysics and orthotics, so a job position at DEKA R&D Corp. back in my hometown of Manchester, N.H., definitely something that intrigues me. I have confidence that the biomedical engineering program here at UMass Lowell would prepare me well for such a job."

His classmates, Arilan McElroy of Atkinson, N.H., agrees. "I decided to come to UMass Lowell because of the opportunities this university has in teaching other engineering disciplines. I trust that the biomedical engineering program here will end up being just as well-renowned and respected as the university’s leading mechanical, civil, chemical, electrical and computer engineering programs."

She adds: "I’ve also started working with eNABLE Living, a group supported by the DifferenceMaker that designs and creates 3D-printed prosthetic devices for kids who are in need of artificial limbs or upper limbs. Working with the group has been such a fantastic experience because the whole team has been hard working and willing to teach. Through them I have gotten, and will continue, to learn a lot about 3D printing, laser cutting and the prosthetic design process.”

“Large companies that sponsor M2D2 are very excited to have future biomedical engineers focus on medical devices," says McCarthy, who directs M2D2. "One way to teach students about medical devices will be through internships with these companies at M2D2. Every freshman has expressed interest in doing internships next summer."

The BME program incorporates coursework traditionally affiliated with the medical field (biology, anatomy and physiology, biotechnology) and business (economics, statistics, entrepreneurship) while maintaining the rigor of a traditional engineering program (statics, dynamics, circuits, design, etc.).

Two senior biomedical capstone projects are also required.

"At capacity, the program is expected to produce about 100 graduates annually, ready to join the workforce or pursue advanced educational opportunities," says McCarthy.

PERRY HALL RENOVATION

A Department of Biomedical Engineering has been proposed, and the new building will be housed at Perry Hall on North Campus. The four-story building, which first opened in 1952, is scheduled to undergo major interior and exterior renovation starting next year. A total of nearly 12,000 square feet of brand-new research and teaching labs, offices and common collaborative spaces has been designated for BME workforce development. The shared spaces will allow students to interact directly with representatives from industry, government and academia, so they can work on projects alongside visiting engineers and scientists.

The renovation project is expected to cost $48 million. The university hopes to raise the funds from external sources, including corporate partners and the Massachusetts Life Sciences Center. The Boston architectural firm Perkins+Will has developed the preliminary design plans for Perry’s modernization. Once completed in 2019, the new Perry Hall will serve as an integrated center for the university’s leading engineering disciplines, not only biomedical engineering but also in biomanufacturing, clean energy and environmental engineering.

Joseph C. Hartman, Ph.D., PE Dean, Francis College of Engineering University of Massachusetts Lowell
Lung cancer is the leading cause of cancer death in the United States, with a five-year relative survival rate of only 15.8 percent for smokers and non-smokers combined, according to the U.S. Centers for Disease Control and Prevention. Most lung cancer does not cause any symptoms until the disease has spread. That is why detecting it early, when treatment is more likely to be effective, is of utmost importance.

Diagnostic tools that physicians use to conduct initial tests for lung cancer can include chest X-rays and low-dose computed tomography (CT) scans. Unlike a regular chest X-ray, which takes a single two-dimensional image at a time, the CT scanner takes multiple X-ray images as it rotates around the patient lying on a table. A computer then combines the images to create a detailed, three-dimensional cross-section of the patient’s body. The downside is that the procedure exposes the patient to a higher dose of radiation than the chest X-ray.

“Ours is a low-dose CT scan for lung cancer screening for an adult is about 0.5 millisievert, which is comparable to a single radiographic chest X-ray,” explains Yu.

To accomplish this, Yu and his group are combining state-of-the-art biomedical imaging techniques called “statistical iterative reconstruction” and “dictionary learning.” Statistical iterative reconstruction uses special algorithms and statistical modeling to reconstruct 2-D and 3-D scans of the lungs with less image artifacts when the raw data is noisy or incomplete. Dictionary learning uses mathematical signal processing to remove noise and improve image quality.

“Our method will benefit the more than 90 million current and former smokers in the country who are at high risk for lung cancer,” notes Yu.

REDDUCING TREATMENT COST AND ANXIETY

Yu points out that over-diagnosis incurs unnecessary follow-up treatment, cost and anxiety to patients. In the National Lung Screening Trial (NLST), low-dose CT images that reveal any non-calcified nodule of greater than 4 millimeters in size were classified as positive, or suspicious, for lung cancer. “Other abnormalities such as adenopathy or effusion were classified as positive as well,” he says.

With low-dose CT, the rate of positive screening tests in the trial was 24.2 percent, and 96.4 percent of those positive tests were “false positives.” Nodules between 4 mm and 1 centimeter in size were followed up with repeated CT scanning over the next three to six months. Biopsies were also recommended for nodules larger than 1 cm.

In response to this over-diagnosis, Yu is working on another research project to develop novel imaging biomarkers so that the rate of false positives could be greatly reduced while maintaining the rate of “false negatives” to current levels.

“The key is to explore hidden information in the CT images from the NLST database using cutting-edge deep machine learning techniques and algorithms,” he says.

Yu’s research is funded by the National Science Foundation and the National Institutes of Health, with grants totaling more than $1 million. His collaborators include computer science Assoc. Prof. Yu Cao and electrical and computer engineering Prof. Yan Luo, as well as clinical physicians from Massachusetts General Hospital, medical physicists from Stanford University, biomedical imaging experts from Rensselaer Polytechnic Institute, algorithmic mathematicians from the University of Central Florida and industry leaders from GE Global Research Center.
In the past decade, nanotechnology has become an important tool in the fight against breast cancer. Using nanoparticles measuring only billions of a meter in size, doctors are able to deliver drug molecules directly to the affected tissue. A nanoparticle-based drug called Abraxane is being used in clinics worldwide to treat breast cancer patients,” says chemical engineering Aust. Prof. Prakash Rai. “However, the disease continues to be a major health concern.”

Breast cancer is one of the leading causes of cancer deaths among women in the United States. According to the U.S. Centers for Disease Control and Prevention, in 2013 nearly 231,000 women were diagnosed with the disease, and close to 41,000 died from it. “There is a dire need for better, more effective treatments with lower side effects,” says Rai.

Common side effects of chemotherapy include nausea, weakened immune system and loss of weight, appetite and hair. Some side effects can be life-threatening, such as hyper-sensitivity reactions and decreasing white blood cell count. Rai was awarded a grant by the National Cancer Institute at the National Institutes of Health (NCI/NIH) totaling more than $725,000 to study a combined, nanotechnology-based diagnostic/therapeutic strategy for the targeted treatment of two subtypes of breast cancer: the human epidermal growth factor receptor 2 positive (HER2+) and the triple-negative breast cancer (TNBC).

“HER2-positive and TNBC are among the most difficult types of breast cancer to treat, with resistance to primary treatments a major issue in patients with recurring disease,” notes Rai.

THE EMERGING FIELD OF THERANOSTICS

Theranostics, a combination of therapeutics and diagnostics, is a relatively new field in medicine that helps doctors decide the best therapy to prescribe for each patient. Instead of a broad, generic approach to treatment, this personalized medicine ensures the patient will receive only the drug or the treatment needed, thereby maximizing the therapeu- tic benefits while minimizing unwanted adverse side effects.

Rai and his research team combined several therapeutic agents that have shown potential in cancer treatment into a single nanometer-sized targeted drug-delivery platform—called a “theranostic nanoconstruct,” or TN C—and tested the nanoparticle’s treatment effectiveness in lab mice. “The combination of these therapeutic agents with an imaging agent into one TN C helps reduce the dose required in a patient to achieve efficacy, thus reducing the toxic side effects,” explains Rai.

He says the imaging agent helps the team locate the TN Cs and track them after they have been injected into the body, leading researchers to the cancerous tissues.

“Targeting the TNCs specifically to cancer cells helps reduce collateral damage to healthy, normal cells,” notes Rai. “If successful, these image-guided, targeted therapies should make a significant impact on the clinical care of breast cancer patients by improving survival and overall quality of life.”

“Nanoparticle-based treatments can target the disease with a wide degree of variability even within the same subtype of a particular cancer,” he says.

“This is what makes it very difficult to treat using the one-drug-fits-all approach that has been traditionally used,” says Rai.

Theranostic nanomedicine offers the potential to detect, image and treat the disease at the same time. It is also possible to assess and monitor the patient’s response to the treatment and, if required, initiate secondary treatments to cure the disease, he adds.

LOOKING INTO THE FUTURE

Rai says the theranostic nanotechnology-based platforms being developed in this project are broadly applicable not only to other types of cancer, but can also be easily adapted to treat other diseases, including atherosclerosis and infectious diseases such as tuberculosis, leishmaniasis, HIV/AIDS and malaria, as well as neurodegenerative diseases such as Alzheimer’s and Parkinson’s.

“We are working on designing nanoparticle-based combination treatments against two other deadly cancers—pancreatic cancer and an aggressive form of brain cancer called glioblastoma multiforme,” he says.

Rai says the idea is to take two or three drugs with different biological targets and combine them inside well-designed nanoparticles. These nanoparticles would be able to release these drugs in different areas of the tumor at different points in time, thus improving their anti-cancer activity and helping reduce the dose of the individual drugs needed to shrink or destroy the cancer.

“The reduction in dosage can help minimize the bad side effects of these drugs on healthy cells. This should help more cancer patients to not only live longer, but their quality of life will also be considerably improved,” he notes.

Rai and his team are still working on the synthesis of the nanoparticles to collect preliminary data for a new grant applica-
tion. “We are looking to collaborate with a researcher from Uniformed Medical School who has expertise in animal testing of nanomedicines,” he says.

Rai adds, “Although theranostic nanomedicine as a field is still in its infancy, in the near future it is expected to significantly impact patient care by making it possible to treat each patient with a personalized treatment unique to his or her disease.”

Rai completed his postdoctoral training at the Massachusetts General Hospital/Harvard Medical School and joined UMass Lowell’s Department of Chemical Engineering in September 2012. He earned a bachelor’s degree from the University of Mumbai in India in 2003 and master’s and doctoral degrees in chemical and biological engineering from Rensselaer Polytechnic Institute in 2007.

Graduate student Sven Bi uses the Material Characterization Laboratory at Olin Hall on North Campus to conduct his research on using nanoparticles to combat breast cancer.

Photo on the right: This close-up view of a breast cancer cell captured with a scanning electron microscope shows the cell’s surface details and overall structure. Courtesy National Cancer Institute.
Tissue-Engineered Implant Requires Less Invasive Surgery

The human heart is an engineering marvel, an efficient machine that beats an average of between 60 and 100 times per minute in healthy adults. That’s equivalent to between 86,000 and 144,000 heartbeats each day.

An integral part of the heart that enables it to pump blood efficiently and keep it circulating in the right direction is the valves. Made of strong, thin flaps of tissue called leaflets, the heart’s four valves act as one-way inlets and outlets, opening and closing the heart’s four chambers with each beat.

Age, birth defects, infections, rheumatic fever or other conditions can cause one or more of the valves to not open fully or allow blood to “leak” back into the heart chamber, potentially leading to heart failure, blood clots, stroke or cardiac arrest. Currently, no medicines are available to cure heart valve disease. Eventually, the faulty valves may need to be repaired or replaced through surgery.

“Traditional artificial valve replacements currently used by doctors can harden or wear out over time,” says mechanical engineering Assistant Professor Scott Stapleton, a researcher at the Aachen University. “And open-heart surgeries are very invasive and carry high risk of death.”

To address these issues, Stapleton and collaborators from North Carolina State University and RWTH Aachen University in Germany are developing tissue-engineered heart valves that can be implanted using a catheter (thin tube) inserted into an artery through a small incision in the groin or chest. This less invasive procedure can cut the cost of the operation and the patient’s hospital recovery time, especially for the young and elderly.

“Tissue-engineered means the valve is grown from the patient’s own cells to create a living and growing organ,” explains Stapleton. “This also means there is less chance of the body rejecting the implanted valve.”

Unlike artificial mechanical valves that can cause potentially lethal blood clots to form, patients with tissue-engineered valves are not required to take blood-thinning medicines for the rest of their lives, which is especially beneficial for pediatric patients.

Another upside for young patients is that the valve will continue to grow with them, so they would probably not need follow-up surgery to replace the valve after about 10 to 15 years. This lessens the emotional, physical and financial stress on patients and their families.

REINFORCING THE VALVE WITH TEXTILE FIBERS

According to Stapleton, most tissue-engineered valves under study today are well suited for replacing the pulmonary valve, which allows oxygen-poor blood to be pumped from the heart to the lungs. But they are currently not strong enough to withstand the high pressures found on the aortic side of the heart, where oxygen-rich blood from the lungs is pumped forcefully from the heart out to the rest of the body. To strengthen the tissue-engineered valve’s structure, Stapleton and his colleagues have reinforced the valve with a scaffold made of polyester (polyethylene terephthalate, or PET) textile.

“We have to make sure that there is enough reinforcement to improve the valve’s strength and durability, but not so much that the valve becomes too stiff and cannot open and close fast enough. If the valve is too soft, it will tear under pressure,” notes Stapleton. “Therefore, the textile-reinforced valves must be carefully engineered.”

To aid the team in designing the textile reinforcement, a computer model is being created that will look at the tissue, the textile and the entire valve to predict its strength and closing speed.

“The growth and development of the cells around the tissue is particularly difficult to capture, and it is not known what effect the textile will have on the cells. Once the model is created and shown to work correctly, it will be used to compare different textile designs to make a strong, functional aortic heart-valve prosthetic,” says Stapleton.

He adds: “My work involves mainly the numerical modeling of the valve to account for tissue growth and adaptation to load during the conditioning process, as well as modeling the effects of the textile reinforcement on the valve’s mechanical performance.

“My primary goal is to gain insights into how the tissue-engineered valves work and how to improve them. My colleagues at Aachen University are the ones conducting the actual tissue engineering and clinical trials,” says Stapleton.

The team’s findings were reported last year in the journal “Advanced Modeling and Simulation in Engineering Sciences.”

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Diagnosing Early Onset of Alzheimer’s Disease

Joyita Dutta Combines the Power of MRI and PET Scans to Get a Clearer View of the Brain

It starts out as memory loss—forgetting names, places, dates or phone numbers and misplacing things. Most people tend to dismiss such lapses as normal aging, but as Alzheimer’s disease progresses, the symptoms can include confusion and increasing difficulty in communicating, working or organizing. Eventually, patients in late stages of the disease require around-the-clock care.

According to the Alzheimer’s Association, there are 5.4 million Americans living with the disease today, including an estimated 210,000 under the age of 65. By 2050, up to 16 million will have Alzheimer’s. While treatments for managing symptoms are available, there is currently no known cure for Alzheimer’s. Researchers around the world are working to change that with projects targeting improved prevention, diagnosis and treatment.

“T jokes can develop biomarkers that precisely quantify these abnormal proteins in living patients through imaging, we can help doctors diagnose Alzheimer’s in its early stages, allowing them to accurately monitor the progression of the disease and develop disease-modifying therapies such as anti-amyloid and anti-tau treatments,” explains Dutta.

A PIVOTAL ROLE IN RESEARCH AND THE CLINIC

According to Dutta, tau tangles are known to have a strong connection with neurological degeneration and cognitive deficiencies in the brain. In recent years, new injectable radioactive drugs called “radiotracers” have been developed for positron emission tomography (PET) that can help visualize tau tangles in living patients. PET is an imaging technique that tells physicians how the tissues and organs are functioning. In this case, a radiotracer called “fluorine-18” collects in brain areas with elevated levels of chemical activity, which usually correspond to the diseased areas. On a PET scan, these show up as bright spots or regions.

“My research aims to develop computational methods for generating high-resolution images of tau tangles and studying the spatial distribution and connectivity patterns of these abnormal proteins,” explains Dutta. “By using information from high-resolution MRI (magnetic resonance imaging) scans of the brain, I am able to enhance the resolution of PET images of tau tangles to a level that enables us to measure tau accumulation in small brain structures, which is vital in Alzheimer’s research.”

Dutta says that by acquiring time-series images and modeling the rates of biochemical reactions of the radiotracer, she is able to derive measurements of tau that are far more accurate than what a traditional static PET image provides.

She adds: “I am using high-resolution tau imaging to understand the relationship between the tau connectivity networks and the structural network of the brain, the latter being based on the actual physical connections between neurons. These will yield new tau-based biomarkers for Alzheimer’s, which are expected to play a pivotal role both in research and in the clinic.”

Dutta’s research is supported by a five-year, $603,000 grant from the National Institute on Aging. She is collaborating with Massachusetts General Hospital and Harvard Medical School on the project.

Among the investigators involved in Alzheimer’s research is Asst. Prof. Joyita Dutta of the Department of Electrical and Computer Engineering, who leads the Biomedical Imaging and Data Sciences Laboratory at UMass Lowell. Her lab is involved in developing novel image- and data-processing tools that merge traditional signal processing with the emerging field of data science.

“My goal is to develop imaging-based biomarkers—measurable substances in the patient’s brain whose presence are indicative of Alzheimer’s disease,” says Dutta, who is also a radiology instructor at Harvard Medical School and assistant in physics at Massachusetts General Hospital.

The hallmark indicators for Alzheimer’s are two types of abnormal proteins that aggregate in the brain: beta-amyloid plaques and tau tangles, both of which appear many years before the onset of any symptom, Dutta says. “The plaques build up in the spaces between the brain’s nerve cells, called neurons, disrupting communication between cells. Tangles, on the other hand, accumulate inside the cells, damaging and killing them.”

Scientists do not know for certain what causes Alzheimer’s disease, a debilitating neurodegenerative disorder that afflicts millions of people. They suspect the accumulation of abnormal proteins in the brain to be responsible for cell death and tissue loss in the Alzheimer-affected brain, resulting in irreversible memory loss, personality changes and, eventually, physical and mental disabilities.
The ultimate career goal of Ph.D. candidate Tina Dardeno ’14 is to become a researcher in biomechanics and professor of biomedical engineering.

He femur, or thighbone, is the longest and strongest of the body’s more than 200 bones. It is attached to the hip bone with a smooth, cartilage-lined ball-and-socket joint. The joint carries not only the full weight of a person’s body, but it can also withstand the pressure and impact of walking, running and jumping as well as lifting heavy loads.

Over time, the cushioning layer of cartilage gets worn out or damaged due to age, arthritis or traumatic injury, often requiring the joint to be replaced surgically with an artificial implant made of metal alloy and polyethylene plastic or ceramic. During total hip replacement, also called total hip arthroplasty, it is difficult for surgeons to gauge how much pressure to apply to seat the implant. Too little pressure, and it may not properly attach; too much, and it may fracture the femur.

Mechanical engineering Ph.D. student Tina Dardeno ’14 intends to make the process less of a guessing game. The National Science Foundation (NSF)—which recently awarded her a prestigious Graduate Research Fellowship Award—believes she can do it.

“When a young, active or heavy person requires hip replacement, the orthopedic surgeon typically chooses ‘cementless’ implant technology, which is stronger and allows the patient’s natural bone to grow directly onto the prosthesis without using any adhesives,” says Dardeno, who is a graduate research assistant at the university’s Structural Dynamics and Acoustic Systems Laboratory (SDASL). “After sawing off the femur’s head, the surgeon uses a special tool to widen the femoral canal just enough so that the implant’s long, pointed stem can be tightly fitted into the canal.”

Dardeno says residual stresses from the tight fitting are required for the implant’s long-term stability, and measuring the magnitude of these forces is critical. “An implant is properly seated when the stresses are high enough to prevent microscopic movements of the implant, but low enough to avoid fracturing the femur,” she explains. Currently, no method exists that can accurately assess the implant’s stability during the operation. “Surgeons must rely solely on their clinical experience to determine the right amount of pressure to apply to properly seat the implant,” says Dardeno.

In response, she is currently developing a non-contact, non-invasive method for monitoring the insertion and seating of cementless femoral implants in real time. Using an implant and full-size femur replicas, she will conduct analytical modeling and vibration analysis of the femoral areas that will normally be exposed during surgery. She will measure the strain on the implant’s head using digital image correlation, an optical technique that employs multi-plane high-resolution video cameras to create precise 3-D measurements of a material’s deformation, vibration and stress. Dardeno plans to expand her modeling to encompass not only the head but the entire length of the implant.

“My goal is to characterize the distribution of strain throughout the implant,” she says. “The resulting full contour map can potentially be used to predict the location and severity of fractures during insertion of the femoral implant.”

Dardeno transferred to UMass Lowell in the fall of 2011, after completing a bachelor’s degree in nursing (summa cum laude) at Northeastern University and passing the board exam in 2010. She earned a bachelor’s degree in mechanical engineering (summa cum laude) from UMass Lowell in 2014. “My education and experience as a nurse and engineer make me uniquely qualified to pursue this research,” she says.

AN NSF GRADUATE RESEARCH FELLOW

According to the NSF, the Graduate Research Fellowship Program supports outstanding graduate students “who can contribute significantly to research, teaching and innovations in science and engineering. These individuals are crucial to maintaining and advancing the nation’s technological infrastructure and national security as well as contributing to the economic well-being of society at large.”

“Tina’s research clearly demonstrates her ability to bridge engineering with the medical field and address a very important issue that has both technical and societal benefits,” says mechanical engineering Prof. Peter Autaril, who is director of SDASL and Dardeno’s thesis advisor.

Dardeno will receive from the NSF a three-year, annual stipend of $34,000, along with a $12,000 cost-of-education allowance for tuition and fees (paid to UMass Lowell) and opportunities for international research and professional development. Earlier in her academic career, Dardeno spent six months as research co-op student in an endotechnology lab at Beth Israel Deaconess Medical Center in Boston and also held a summer internship at Instrumentation Laboratory in Bedford, Mass. In 2014, she was awarded the Dean’s Gold Medal for highest achievement in mechanical engineering as an undergraduate. To date, she has two papers published in peer-reviewed journals as well as several conference papers.

“My experiences working in the SDASL will surely be invaluable to my career,” says Dardeno. “They provide the foundation and hands-on research training I need beyond the classroom. Having faculty mentors who emphasize both experimental and analytical structural dynamics and acoustics has given me a very complete and well-rounded education.”

“Having faculty mentors who emphasize both experimental and analytical structural dynamics and acoustics has given me a very complete and well-rounded education.” —Tina Dardeno ’14

This X-ray image shows what the new hip joint looks like after replacement surgery. The implant’s long metal stem is pressed tightly into the central canal of the femur, or thighbone, while the implant’s ball and cap fit into a corresponding socket attached to the pelvis, providing mobility and support to the body.

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COMMERICALIZING NEW TECHNOLOGIES

The acquisition of Anterios by Allergan translates into a $3.8 million equity payout for UMass Lowell and $11.8 million for the UMass system. It’s the largest intellectual property deal to date for UMass Lowell, according to Rajnish Kaushik, assistant director of UMass Lowell’s Office of Technology Commercialization (OTC).

OTC oversees protection and commercialization of intellectual property developed by faculty at UMass Lowell with the mission of facilitating the transfer of technology arising from that research to the private sector via licensing to startups and established companies. “This successful exit of a startup based on UMass Lowell’s intellectual property speaks to the creativity of our faculty and the opportunity for their research to have an impact both on people’s lives and on economic development,” says Kaushik. “Startups play a significant role in bringing technologies born in academic laboratories into the marketplace. The entrepreneurial spirit at UMass Lowell and across the UMass system helps fuel this success.”

Collaborating in the research were biology Prof. Tom Shea, clinical laboratory and nutritional sciences Assoc. Prof. Tom Wilson and chemical engineering Assoc. Prof. Carl Lawton. Balint Koroskenyi contributed to the group’s work as a UMass Lowell post-doctoral researcher, and Jean-Bosco Tagne, Fongshu Kuo and Sirkhan Taihurmanu participated while they were doctoral students at the university.

The revenue generated for UMass Lowell from this license will be invested to advance the commercialization of other technologies and other research being conducted at the university, according to OTC. McCarthy adds that the drawn-out process to get technology from the lab to the market is what inspired him to establish M2D2 in 2010. “Because of the long licensing process of Anterios, I realized that there were a lot of patents filed in Massachusetts that resulted in products that never made it to market,” he says. “Large companies would not license these patents because they were deemed too risky. We call this the ‘Valley of Death.’ I founded M2D2 to help small companies with medical device patents get through the valley by using UMass Lowell and UMass Worcester to provide product, business and medical development such that they are then able to raise money and eventually get to market.”
In March, CareFusion was acquired by New Jersey-based Becton Dickinson (BD). Michael says the respiratory solutions division, composed of respiratory and anesthesia products, is being spun out as a new business venture between BD and Aparna, a private equity firm. CareFusion’s respiratory business revenue last year was about $500 million.

FINING SOLUTIONS, OVERCOMING CHALLENGES

Michael and Carolyn both graduated from the university, then called the University of Lowell, in 1987 with bachelor’s degrees in chemical engineering. They were pursuing master’s degrees in physical engineering when they were recruited by California to Baxter Healthcare in 1989. “We were dating in grad school and we had made it known that we were looking for geographically compatible job opportunities,” Michael recalls. “The company hired both of us—me in R&D and Carolyn in product engineering—and they relocated us to Valencia.”

“We really enjoyed our years at UMass Lowell. The engineering program was tough, but it prepared us to enter the professional workforce by providing fundamental engineering skills and a good attitude about working hard and getting results,” Michael says of a trip to UMass Lowell this past June, and the school has made amazing improvements to the facilities and campus life,” he says.

“Seeing our products in use on patients and receiving positive feedback from caregivers on how our products have improved patient care is our greatest accomplishment,” says Carolyn, who is vice president of research and development for the company’s respiratory and anesthesia markets.

Michael, on the other hand, is vice president of product engineering for respiratory consumables and oversees engineering teams in Yorba Linda, Calif., Mexico, Finland and Shanghai, China. “We are involved mainly in sustaining engineering, process development and design handling of new products and cost-improvement projects.”

In her responsibilities include designing and developing new products for the respiratory and anesthesia markets.

Michael and Carolyn McMahon ’87 Work in Respiratory Care R&D

Alumni Couple Helps People Breathe Easy

Michael and Carolyn McMahon ’87 Work in Respiratory Care R&D

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Gulden Camci-Unal has been appointed assistant professor of chemical engineering. She received her doctorate from the Georgia Tech and held postdoctoral positions at Harvard, MIT and Harvard Medical School.

Danji Chen has been appointed assistant professor of civil and environmental engineering. She earned her doctorate from Georgia Tech and held postdoctoral positions at Cornell and University of Wisconsin.

Raj Gondle has been appointed lecturer in civil and environmental engineering. He obtained his Ph.D. from West Virginia University.

Fajalgud Liu has been appointed assistant professor of chemical engineering. He received his doctorate from Penn State and was previously a faculty member at the University of Texas, Arlington.

Marialiana Malariu has been appointed assistant professor of civil and environmental engineering. She earned her Ph.D. from Turin Polytechnic Institute in Italy and held postdoctoral positions at the University of Michigan and University of Washington.

Javier Vera-Sorrocche has been appointed assistant professor of plastics engineering. He obtained his doctorate from the University of Bradford (U.K.) and worked previously with the company Smithers Rapa (U.K.).

Thanka Wickramarathne has been appointed assistant professor of electrical and computer engineering. He received his Ph.D. from the University of Miami and was previously with the University of Notre Dame.

Dongming Xie has been appointed associate professor of chemical engineering. He received his doctorate from the Chinese Academy of Sciences and worked previously at DuPont.

Faculty Successt

Asst. Prof. Juan Pablo Trelles (mechanical engineering) has been awarded a National Science Foundation (NSF) CAREER Award for his project: “Sustainable Chemical Synthesis by Plasma-Assisted Hydrosol Fragmentation.”

Oliver Ibe has been promoted to professor of electrical and computer engineering. He was also elected a Fellow of the African Academy of Sciences, which has over 300 fellows based in 44 countries.

Distinguished University Professor Prof. Stephen McCarthy (plastics engineering) has been elected a Fellow-of-the-Society by the Society of Plastics Engineers.

Asst. Prof. Joyita Dutta (electrical and computer engineering) won the Macy’s Foundation Memorial Award from the Society for Nuclear Medicine and Molecular Imaging (see page 8).

New Faculty

New Research Awards

Prof. Peter Avitable (mechanical engineering) was awarded a grant from the Air Force Office of Scientific Research (AFOSR) for his project: “Collaborative Research: Liquid-Fueled Turbine Engines for Unmanned Aerial Vehicles.”

Asst. Prof. Allirea Amirizah (mechanical engineering) was awarded a grant from the U.S. Army Natick Soldier Research, Development, and Engineering Command for her project: “Protective Fiber-Matrix Interface Materials for Robust Rigid Composites.”

Asst. Prof. Sukanta Tripathy (mechanical engineering) was awarded a grant from the Department of Energy (DOE) for his project: “Renewable Energy Conversion Using Complex Polymeric Nanocomposites.”

Asst. Prof. Akshay Kulkarni (chemical engineering) was awarded a grant from the National Science Foundation (NSF) for his project: “Multiscale and Multiphase Flows in Porous Media for Enhanced Oil Recovery.”

Student Successt

Mechanical engineering student Taitishi Ash has been appointed a Department of Energy (DOE) Integrated University Program Scholarship.

For the fourth time in six years, UMass Lowell team of engineering students won the SME Design for Direct Digital Manufacturing Competition, which was held this year in Orlando, Fla., in May. The mechanical engineering team of Titto Arana, Jordan Castillo, Michael Gager, Dan Stella and Josefa Vasquez won the award for their “JumboGrill” design, which can be used to visually assess the condition of bridges. They were advised by Asst. Prof. Stephen Johnston (plastics engineering).

The UMass Lowell team of engineering and business students placed second overall at the NEUBOOTC Collegiate Wind Competition held in May in New Orleans, improving on their fourth-place finish from last year. The team was co-advised by Michael Darish, Christopher Hansen, Stephen Johnston, Christopher Niezrecki, Tom Reagor, William Still and David Willis.

Environmental engineering student Choon Sun (mechanical engineering) was awarded a President’s Office of Technology Commercialization and Venture Grant for his project: “Multiscale and Multiphase Flows in Porous Media for Enhanced Oil Recovery.”

Dr. B. Sivaprasad (mechanical engineering) was awarded a grant from the Department of Energy for his project: “Interfacial Mass Transport in Porous Media for Enhanced Oil Recovery.”

University and College Notes

UMass Lowell moved up to No. 152 (No. 78 among public institutions) in the latest U.S. News & World Report rankings for national universities. This is the highest ranking in the history of UMass Lowell.

The NSF has awarded UMass Lowell a $1.6 million grant to support the development of technologies that can be used to advance offshore wind energy research and development. The project is led by the Massachusetts Clean Energy Center (Photo 6).

Niezrecki and Asst. Prof. Murat Inalpolat (mechanical engineering) have received grants from the Commonwealth totaling $200,000 to advance offshore wind energy research and development. The project is led by the Massachusetts Clean Energy Center (Photo 6).

The NSF has awarded UMass Lowell a $1.6 million grant to support the development of technologies that can be used to advance offshore wind energy research and development. The project is led by the Massachusetts Clean Energy Center (Photo 6).

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Five students from the engineering, computer science and business departments were also awarded National Science Foundation (NSF) grants for their projects: "Novel Nanoscale Metal Networks for Energy Storage," "Making WAVEs: Disrupting Microaggressions to Propagate Institutional Transformation," which aims to create an academic environment that supports STEM education and includes investigating team members Assistant Professor Jacqueline Moloney, Vice Chancellor for Research and Innovation, Julie Chen, Prof. Meg Bond (psychology), Assoc. Prof. Marina Ruths (chemistry) and Assoc. Prof. Meng Sobkowiak-Kline (plastics engineering), who will serve as engineering liaison for the WAVEs program.

The NSF has also awarded UMass Lowell an Industry/University Cooperative Research Center (IUCRC) for an Advanced Membrane Bioremediation Innovation Center, in collaboration with Johns Hopkins University, Clemson University and the University of Delaware. The proposed center will focus on reducing the time and cost of developing biopharmaceuticals. The project’s principal investigators are Yoong and Asst. Prof. Carl Lawton (chemical engineering).

The Heroin Portal, under the direction of Nagaranjan, continues to build its alliance with the U.S. Army Natick Soldier Research, Development, and Engineering Center. This center-year, a total of nine projects have been funded at roughly $700,000. The principal investigators include John Lawton, Assoc. Prof. Emmanuel Reynaud (mechanical engineering), Nagaranjan, Prof. Alkin Akyurtlu (electrical and computer engineering) and Kurup.

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**Volunteering**

**WANT TO CHANGE LIVES—INCLUDING YOUR OWN?**

Become a UMass Lowell volunteer. You’ll make a difference in the lives of alumni and students, while also building your résumé and making connections that can last a lifetime.

**MARKETING & COMMUNICATIONS**

*Spread the word about our events and programs!*

- Become a Social Media Ambassador by sharing news on Facebook, Twitter and LinkedIn.
- Submit a class note.
- Call or email your classmates to encourage them to attend an event.

**CAREER SERVICES**

*Recruit a River Hawk!*

- Mentor alumni and students in person or through our online platforms.
- Post jobs and internships for alumni and students on CareerLINK.
- Make connections by serving on a panel or as a class speaker.

**SCHOLARSHIP SUPPORT**

*You make the difference!*

- Identify creative ways to fundraise for student organizations and scholarships.
- Sign letters, send emails or make phone calls to encourage alumni to participate in specific initiatives.
- Host a reception at your home.

**ALUMNI PROGRAMS**

*Help us plan and recruit for events geared toward professional development, networking and lifelong learning, including:*

- Social and pregame gatherings.
- Affinity programs (based on student experience, cultural identity or professional affiliation).
- Lectures or workshops with industry experts.

**ADMISSIONS**

*Share your story with prospective students across the country!*

- Attend a college fair on behalf of the university.
- Host an admissions reception in your area.
- Make congratulatory calls to admitted students.

To learn more about how you can be involved, contact the Office of Alumni Relations at 978-934-3140 or Alumni_Office@uml.edu.

alumni.uml.edu/volunteer