# *Stephanie Farrell*
## of Rowan University

By Doug Clauson

Dr. Stephanie Farrell sees the world differently. Through her lens, the everyday aspects of life that others may find routine strike her as creative ways to excite students about engineering. To most people, the sight of coffee brewing on the kitchen counter is nothing out of the ordinary. Farrell sees an interesting prop for teaching reverse engineering principles. Even common forms of exercise like a jog or hike in the park don't escape her radar. To Farrell, a former Division I college swimmer and active runner and hiker, these familiar recreational experiences present great examples of chemical engineering principles. In her classroom, life itself is the perfect engineering textbook.

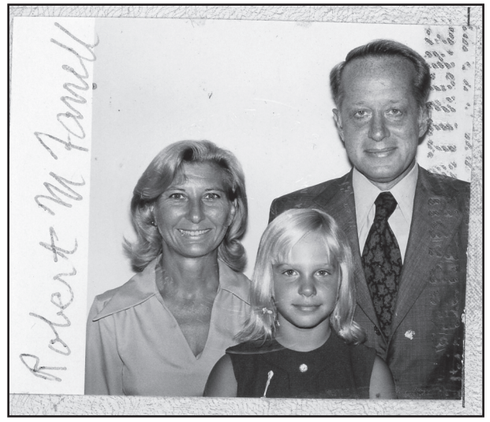
"We all see things from our own perspectives," notes Farrell. "I view the world through the eyes of an engineer, so I am always curious about how things work. I try to take the appreciation I have for everyday life and develop fun, hands-on approaches for teaching engineering concepts. Learning through familiar experiences not only engages and motivates students, but it also provides a bridge to complex concepts later on and supports higher long-term retention rates among science and engineering students."

*Stephanie on the third day of her group's climb up Mt. Kilimanjaro in 2012.*

As a professor of chemical engineering at Rowan University in Glassboro, New Jersey, Farrell has spent her career improving engineering education. She is a pioneer of innovative forms of experiential learning and has worked tirelessly in making engineering education more accessible throughout the world. At Rowan she has brought experiential learning to a new level, filling the university's renowned engineering clinic program with novel hands-on workshops—many even building off of the rich and diverse experiences of her own personal life.

### FINDING HER OWN PATH

People who knew Farrell when she was younger probably didn't envision her becoming a chemical engineer. As the only child of Robert and Barbara Farrell, she was raised in Chatham, New Jersey, surrounded by the arts, rather than science. Her father has a graduate degree in music theory from the University of Pennsylvania and spent his entire career as a writer for




*Far right, Stephanie with childhood friend Karen Kolba Hoover at a baby shower they hosted for their third-grade teacher. Right, a 1973 passport photo of Stephanie with her parents.*

Western Electric and AT&T. Her mother graduated from the American Academy of Dramatic Arts in New York and worked in advertising. Outside of work, they filled the family home with a love of reading, music, and theater. "We were truly a family of arts and humanities. My parents loved literature and greatly enjoyed reading and going to plays – interests they instilled in me and ones that I still enjoy today," she says.

At age two, Farrell met Karen Kolba Hoover, who lived just a few houses away. They quickly became close friends, sharing many common interests, most of all swimming. "Karen and I were inseparable. She has always been like a sister to me and is still one of my closest friends," says Farrell.

Farrell joined Chatham's Minisink Swim Club when she was six and swam competitively with Hoover for both Minisink and the Madison, New Jersey, area YMCA swim team from the ages of eight to 16. At the Madison YMCA, Hoover's father—Michael Kolba—was the swim team coach, and he helped Farrell to develop into a top breaststroker during her high school years.

Although her parents each had a strong artistic background, Farrell fondly recalls their encouragement and support in helping her find her own way. "They were always very supportive and open to all my academic interests, as well as my athletic pursuits."

At Chatham Township High School, Farrell's academic interests ran the gamut from the humanities and languages to math and science. "I just enjoyed learning and would have been happy studying anything in college," she points out. Ultimately, a casual conversation with her high school chemistry teacher, Nick DeSantis, helped steer Farrell toward chemical engineering. "I remember him telling me about chemical engineering and mentioning that it was a very challenging and rewarding field," she says. "He didn't push me, but the few conversations we had piqued my interest."

Intrigued by her conversation with DeSantis, Farrell explored the idea further on her own, while also speaking with her guidance counselor, friends, and classmates. Her research confirmed what DeSantis had told her—that chemical engineering was a field of study that was known to be intellectually challenging—and indicated the field was underrepresented by women as well.

"While I enjoyed science, I was motivated by the challenge of studying chemical engineering more than anything else," she notes.

One person who is not surprised that Farrell was drawn to a challenge is childhood chum Hoover. "When we were kids, Stephanie always welcomed every opportunity to tackle a new challenge. I still see the same person I knew growing up—someone who is humble and good-natured, with a mind that is wide open to exploring new things," says Hoover.

## "ONE OF THE MOST IMPORTANT PEOPLE IN MY LIFE"

At the start of her senior year in high school, Farrell joined the Summit, New Jersey, YMCA swim team. At the team's first practice, she met Jim Sheil, who would become her best friend for the next 32 years. On the swim team, Sheil became Farrell's closest teammate and de facto coach, encouraging her to always compete at her best. Outside of the pool, they were always together, taking excursions into New York to dance at popular '80s nightclubs like Studio 54 and The Peppermint Lounge or enjoying quiet time in the library reading old newspapers on microfilm.

During the next three decades, they would share a deep friendship that would have a profound effect on Farrell's life. Although college separated them—she attended the University of Pennsylvania and Sheil went to Columbia—they still saw each other frequently. With both competing as swimmers for their respective schools, swim contests between Penn and Columbia also gave them the chance to see each other. Sheil was a devoted letter writer, too, and he wrote to her three times a week during college and in the years that followed. When the Farrell family home in Chatham was destroyed by fire in 2013, she was able to retrieve two things amid the ashes—her childhood jewelry and a box with Sheil's letters.

*Stephanie in 1990 with Jim Sheil riding in the Sahara desert with the pyramids of Giza in the background.*

Among their many common interests was a love for international travel. Egypt was, by far, their global destination of choice. "We were both fascinated by Egypt. The multiple trips we made together became much more than vacations. We collected books about Egypt, studied Egyptian art and culture at the Metropolitan Museum of Art, and even took classes in Arabic at NYU. We became amateur Egyptologists in many ways," she adds. Farrell has several special reminders of her trips to Egypt with Sheil. Among them are the saddles they bought together at a camel market in Cairo, which are on display in her Philadelphia home. At Farrell's wedding to Peter Cole in 1995, Sheil was there standing beside them both as one of their two "best men."

In 2013, Sheil passed away suddenly of a heart attack. For Farrell, a friendship that started at the Summit YMCA pool more than 30 years ago developed into a deeply formative relationship in her life.

## A LIGHT GOES ON AT PENN

Farrell's prowess as a swimmer and exemplary student in high school drew the attention of several Ivy League schools. Swim coaches from Penn and Cornell invited her to campus to spend a weekend with fellow athletes, train with their teams, and gain a personal feel for the school. Equally impressed with the engineering programs at both institutions, as well as their swim teams, she ultimately chose Penn. "It was a very tough decision between Cornell and Penn, but in the end I loved the urban environment of Penn, and it just felt like it was the right fit for me."

At Penn, Farrell greatly enjoyed studying chemical engineering, but she admits that her interest in language and the humanities hadn't entirely waned. "Initially, I considered double majoring in chemical engineering and something in the humanities. But being part of an NCAA Division I swim team was a significant time commitment and something I was dedicated to sticking with all four years at Penn. I just wouldn't have the time for a dual major, so I focused my study in chemical engineering," she says.

Open-minded and with a passion for learning, she pursued her engineering studies determined to find her niche. While she found her coursework intellectually stimulating, she hadn't yet discovered an application area that excited her. "I loved studying chemical engineering, but I couldn't envision myself working in a traditional chemical industry role. It's great for many people, just not for me," she recalls.

Farrell's future path started to become clearer during her senior year at Penn. She took a bioengineering course taught by a number of graduate students. One of them was Dan Hammer, who is now a Penn professor of bioengineering and chemical and biomolecular engineering. "All of the grad students taught a module and related the content to their own research in bioengineering. Up until then, I hadn't had any exposure in the application of chemical engineering to biological systems. I remember thinking that I could really see myself working on something like that," she notes.

## WORK ON ERADICATING MEASLES

Upon graduating from Penn in 1986, Farrell's interest in biomedical applications and drug delivery continued to grow. In the summer of that year she began working on a World Health Organization (WHO) sponsored program on measles eradication. The project focused on the development of a needle-less injector used in vaccinations around the world. According to the WHO, in the early 1980s before widespread

vaccination, measles caused an estimated 2.6 million deaths each year, mostly among children.

Appealing to her was the opportunity to work on the project directly with acclaimed microbiologist Dr. Benjamin Rubin, who was instrumental in the eradication of smallpox during the 1970s. Rubin invented a bifurcated needle that would more readily support smallpox vaccinations worldwide, particularly in developing countries. His invention was credited with saving more than 130 million lives, and by 1980 the WHO had declared smallpox defeated.

Working together with Rubin at the Philadelphia College of Osteopathic Medicine, Farrell conducted research on needleless injectors and how they could be modified for deployment in measles vaccinations in developing countries. Technical challenges, as well as political and social issues including the rise of the AIDS epidemic, slowed the project's progress. Nonetheless, working with Rubin is an experience that she still greatly appreciates. Perhaps it was fate, too, that brought her to work with Rubin. Years later, while engaged in one of her hobbies (ancestry research) she discovered that her fifth great-grandfather—a weaver, not a doctor—had helped inoculate more than 16,000 children against smallpox in the 1700s in Scotland.

"It was inspiring to work directly with a hero of science, someone who had made such a significant impact on human health. Dr. Rubin's efforts were behind a vaccination program that was one of the safest and most cost effective ever," says Farrell.

## EXPLORING RESEARCH INTERESTS

After her research activities in the WHO-sponsored measles project drew to a close, Farrell began focusing on graduate school. Her aim was to find a program that would enable her to dig deeper into the biological applications of chemical engineering. Ultimately, she would land at Stevens Institute of Technology in Hoboken, New Jersey, in September 1988.

Farrell says she was most swayed in her grad school choice by Dr. Kamalesh "Kam" Sirkar who at the time was a professor of chemical engineering at Stevens. Impressed with Farrell's background and research interests, he contacted her about coming to Stevens. "Even though he wasn't primarily focused on biomedical applications, I felt that I could learn a lot from him," she says. During their conversation, Farrell and Sirkar uncovered an area of overlapping interest: the application of microporous membranes in pharmaceutical manufacturing and drug delivery. When Farrell enrolled at Stevens, Sirkar became her advisor and an important early mentor in her career. Like other friends and colleagues who know Farrell, he was similarly impressed by her desire to tackle challenges.

"Stephanie was drawn to research areas that were challenging and dynamic. She was always very curious, willing to learn, and had an infectious enthusiasm that carried throughout our research group," says Sirkar. One of Farrell's primary areas of research at Stevens was the study of controlled release drug delivery systems that utilize soluble tablets surrounded by a porous membrane to manage the diffusion rate. Her research led to the development of a novel controlled release device employing microporous membranes, which she later patented jointly with Sirkar.

Besides the technical challenges of her work, one of the more memorable aspects of her graduate study that she recalls is the rewarding interactions among her fellow students. "Kam brought together a very diverse group of students from India, China, Korea, Greece, and other countries. The multicultural environment was life-changing."

Sirkar says that of all the personal qualities he remembers about Farrell, her kindness and willingness to assist her fellow students stands out. "Our research group had students from all over the world. One particular student from Taiwan was extremely intelligent, but language issues made the writing of his thesis very challenging. In the first draft, his ideas were there but the presentation was not where it needed to be. Weeks later when I read the second draft, it was written much better. I always knew in the back of my mind that it was Stephanie who had helped him," he recalls.

## FIRST TEACHING EXPERIENCE

While at Stevens, Farrell gained her first teaching experience as an instructor in the Stevens summer pre-college program Exploring Career Options in Engineering and Science. The program enables high school students to learn what it means to be a scientist or engineer through academic study and hands-on research in state-of-the art laboratories. To grab students' attention and make the learning both memorable and fun, she devised a unique laboratory experiment on the production of beer. During the course of the two-week program, the students learned about a range of engineering principles through the experience of brewing beer.

"Afterward, all of the students and people involved at Stevens loved what we had done in the program," says Farrell, who adds that none of the students actually drank any of the beer. "It was then that I started to realize the potential that experiential learning had in the study of engineering. That summer experience really helped me uncover my passion for teaching."

## THE BIRTH OF A TEACHING PHILOSOPHY

When Sirkar joined the New Jersey Institute of Technology (NJIT) in Newark, New Jersey, as Sponsored Chair in Membrane Separations and Biotechnology, Farrell went with him to complete her doctoral research. There she met Ann Marie Flynn, a fellow Ph.D. candidate. Outside of class, Farrell and Flynn became close friends. The two discovered they shared a very similar mindset toward engineering education.

"I remember sitting in my lab with Stephanie one day waiting for some results to process. We started talking about how we wished there were better ways to teach complex subjects to new engineering students," says Flynn, now chair of the Chemical Engineering Department at Manhattan College, Bronx, New York. "Our discussion turned to the subject of fluids, specifically teaching the velocity profile of fluids. We both thought how great it would be if you could use a demonstration, such as putting honey on a piece of cardboard and observing it dripping down, to explain the velocity profile. Students could learn by seeing it happen, rather than just reading equations on the white board. From that point, a light went on for both of us, and we continued to discuss innovative ways to improve teaching and gain students' attention early on."

While their discussions greatly fostered Farrell's enthusiasm about an academic career focused on engineering education, her path truly came into view in June 1996. That month, at their own expense, students Farrell and Flynn drove to Washington, D.C., to attend the annual conference of the American Society for Engineering Education (ASEE). At the conference, they found thousands of educators who shared their passion for furthering excellence in engineering education. "We came back from that conference on such a high, knowing that there were countless people out there doing exactly what we were passionate about," notes Flynn. "We were both amazed that we could make a career out of just the things we had been talking about in my lab."

## FIRST FACULTY POSITION

Farrell secured her first faculty position at Louisiana Tech University in Ruston, Louisiana. She started as an assistant professor of chemical engineering and adjunct professor of biomedical engineering in the fall of 1996, culminating a whirlwind two-year period during which she married Cole, completed her Ph.D. at NJIT, and learned her father was diagnosed with Parkinson's disease.

"Leaving the Northeast was very difficult for Peter and me and the timing was awful given the news about my dad," she says. "But I felt very fortunate getting the job at Tech, and the people there were very good to me. It was a great first teaching job and gave me invaluable experience. After a couple of years, Peter and I really missed the Northeast and wanted to get back closer to home."

## THE ROAD TO ROWAN

In spring of 1998, Farrell learned of a faculty opening in the emerging chemical engineering program at Rowan University's College of Engineering. At the time, Rowan was aggressively pursuing its plan to develop a world-class undergraduate engineering college that emphasized hands-on, project-based learning. As part of this concerted effort, the College was in the early stages of implementing a new chemical engineering program under the direction of founding chair Dr. C. Stewart Slater. For Farrell, the opportunity to join the faculty at Rowan was appealing on many levels. It offered a dynamic environment to pursue her experiential teaching ideas and explore her scholarly interests in the areas of bioengineering and drug delivery. It would also bring her and Cole back to the Northeast and closer again to her parents.

"I was familiar with Rowan's plans to pioneer an innovative, hands-on engineering program even before I accepted the position at Louisiana Tech," she notes. "After gaining a few years of teaching experience, I was very excited by the opportunity to be part of what was happening at Rowan."

Going into her interview, Farrell knew that Slater and other members of the faculty were looking for someone who shared their progressive vision for hands-on learning. "During my interview, I gave a presentation on the beer-brewing project I had done for high school students while at Stevens. I explained how I would adapt it for freshman engineering students as part of the engineering clinics that Rowan already had in place. They loved the idea and Stew (Slater) later told me it was one of the main reasons I was hired," she says.

Also appealing to Slater was Farrell's graduate experience in drug delivery and how she could potentially expose students to emerging bioengineering topics through coursework and projects. "To grow our chemical engineering program, we were looking for someone with a background in either the bioengineering or pharmaceutical engineering field who wanted to develop those interests as part of the novel undergraduate curriculum we were building at Rowan," remarks Slater, professor of chemical engineering at Rowan. "Stephanie's technical background in drug delivery, combined with her enthusiasm for engineering education, made her a great fit for Rowan."

## CREATIVITY IN EXPERIENTIAL LEARNING

Farrell began her career at Rowan in fall 1998. Slater remembers that it didn't take long for her to begin to make an impact on the engineering curriculum. "Stephanie hit the ground running as a new faculty member in the chemical engineering program. She became the go-to person in our early years in developing the bioengineering aspects of curriculum and integrating it within the broader framework of our entire program."

Early on, Slater also asked Farrell to teach the Freshman Engineering Clinic course, which is part of Rowan's four-year engineering clinic sequence of hands-on learning projects and laboratory experiments. The Freshman Engineering Clinic immerses first-year students in engineering principles through practical experience and novel projects. "Our clinic program is one of the unique hallmarks of our curriculum. With the wealth of ideas and experience Stephanie had in the

development of hands-on, minds-on learning, we thought she was the ideal person to bring a further level of creativity to the clinic program. The innovative contributions she made in her first couple of years have had an enduring impact on the clinic program's success and helped Stephanie to develop into the progressive educator she is today," says Slater.

Farrell has put her personal stamp on the engineering clinic program at Rowan through a broad range of creative projects that bring engineering principles to life for first-year students. She adapted the beer-production project developed at Stevens into a popular reverse engineering module in which freshmen students analyze the beer brewing process and then finish the semester designing their own brewing process. They even visit a local brewery during the semester. In other popular projects, students reverse engineer an automatic drip coffee maker, and they examine chemical, electrical, and mechanical processes within their own bodies in a project called "Hands on the Human Body." Among the real-world projects she has created for the junior-year clinic program is a module on biodiesel production, in which teams of four students work together to study the process of creating biodiesel from household cooking oils.

"Everyday examples can be very effective in exciting students about engineering. Our clinical projects make engineering accessible through the study of practical applications while also enabling students to immerse themselves in solving real-world issues," says Farrell.

She also has helped forge alliances with leading companies throughout various industries that have led to creation of company-sponsored industrial projects within the engineering clinic program. Faced with real deadlines and deliverables, students have the opportunity to develop their project management, teamwork, and oral and written communication skills. The program also offers industrial sponsors a cost-effective approach to problem solving with potential for a high return on investment, through technical assistance from advanced undergraduate engineering students supervised by faculty. Among the industrial partners are Johnson Matthey, Inc., a global specialty chemicals company, that has sponsored numerous projects on precious metals refining for more than 15 years; General Mills, which supported projects on bagel production; Campbell's Soup Company, which sponsored a project to recover nutrients lost during tomato soup production and a novel baking process for Pepperidge Farm brand Goldfish snack crackers.

## DRUG DELIVERY IN THE CURRICULUM

Drug delivery also continues to be an important aspect of Farrell's ongoing scholarly work. Utilizing her background in drug delivery research, she has integrated critical biomedical engineering topics throughout Rowan's engineering clinic program. In the Freshman Engineering Clinic course, she utilizes experiments that introduce students to drug targeting, and she uses drug delivery examples in her classes to teach principles such as mass balances, mass transfer, and kinetics.

*Stephanie (far right) at a meeting of The National Effective Teaching Institute (NETI) with (left to right) Dr. Rebecca Brent, Dr. Michael Prince, and Dr. Richard Felder.*

Through a series of grants from the National Science Foundation and the National Institutes of Health, she has been able to support the expansion of Rowan's bioengineering curriculum. Her work includes the development of experiments and learning materials related to drug stability testing, transdermal delivery, supercritical fluids, microcapsules, and solid dosage forms, as well as the development and teaching of an elective course in drug delivery (Fundamentals of Controlled Release). Her efforts have resulted in cost-effective, transferable biomedical innovations that enhance student learning outcomes and increase interest in biomedical engineering. These innovations have been disseminated widely and were very well received by the engineering community.

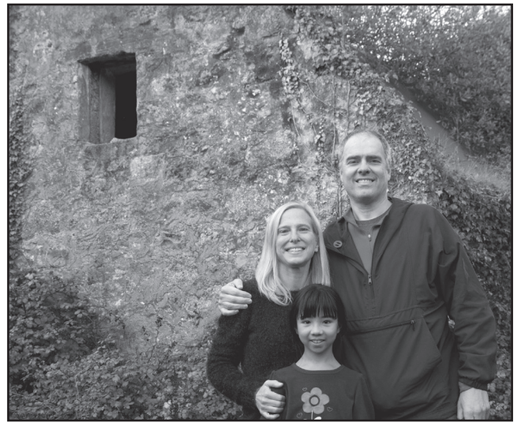
More recently, Farrell teamed with Dr. Jennifer Vernengo, assistant professor of chemical engineering, in a fruitful collaboration that brought together Vernengo's expertise in biomaterials with Farrell's background in drug delivery. Their efforts led to development and implementation of new educational experiments related to drug delivery from polymeric systems, such as pH-responsive hydrogels. Their work has been the basis of several journal articles and numerous conference proceedings, conference presentations, workshops, and invited seminars.

## A TRUSTED MENTOR

When discussing the people who have helped shape her career, Farrell speaks with great enthusiasm about her relationship with Dr. Richard Felder, professor emeritus of chemical engineering at North Carolina State University. One of the most widely respected engineering educators in the world, Felder helped establish The National Effective Teaching Institute (NETI), a three-day workshop for engineering instructors held twice each year since 1991. The NETI provides hands-on practice in the elements of effective teaching, training engineering professors on instructional techniques that can enhance their teaching experience and make learning move rewarding for students.

Newly into her career at Rowan, Farrell was nominated by then-Rowan Engineering Dean Dr. James Tracey to attend





*Stephanie and Peter with daughter Phoebe in Galway, Ireland, in October 2014. In the background is the one-room stone farmhouse where her great-great grandparents lived with eleven children. It was inhabited by their descendants until 1969.*

the NETI in 1999. The workshop was led by Felder; his wife, Dr. Rebecca Brent, president of Education Designs, Inc.; and Dr. James Stice, professor emeritus in engineering at The University of Texas at Austin. "The workshop was truly revitalizing, furthering my passion for engineering education and inspiring my inductive teaching approaches," says Farrell. "We have stayed very close, and Rich has been one of my most trusted mentors and has had a tremendous influence on my teaching and career in chemical engineering education."

In 2010, Farrell was invited to be part of the NETI Fellow Program, which was established to recognize leaders in engineering education. The NETI selects only one fellow each year to co-present the NETI workshop and join a prestigious group of education leaders who help disseminate the methods taught at NETI around the world.

## NEW ADDITION AND NEW RESEARCH AREA

In 2004, Farrell and her husband, an information technology consultant, expanded their family with the adoption of 13-month-old daughter Phoebe from China.

The new joy that Phoebe brought Farrell and her husband soon was tempered by eating problems that Phoebe encountered almost immediately. "At first we thought it was stress from the trip from China that manifested itself through her eating, but that turned out not to be the case," she recalls. Continued problems ultimately led to tube feeding. While she did start to gain weight, Phoebe stopped eating and drinking altogether. Farrell and her husband also grappled with clogging in their daughter's feeding tube. "We had two years of sleepless nights. The tube would clog seemingly every 20 minutes," she says.

They began looking for programs that would support their goal to wean Phoebe off the feeding tube but found no success, only more frustration. Ultimately, they discovered a European program—The Tube Weaning Clinic at the Medical University of Graz, Austria—that uses creative therapies to teach children to recognize hunger and make the connection between food and satiety. During this therapy, the Graz medical team stops using feeding tubes and asks parents not to comfort the hungry children in other ways. "It was extremely hard, but it made a lot of sense," says Farrell, who traveled with her husband and Phoebe to the clinic in 2007. Phoebe took her first bites of food three days into the program, and today she has the diet of a healthy 10-year-old.

The experience inspired Farrell to assist other parents having similar problems with their child's feeding tube. In the fall of 2008, she enlisted a group of her students to explore why feeding tubes clog as part of an engineering clinic at Rowan. She also continues to reach out to the Austrian physicians who helped Phoebe, to collaborate on research related to tube feeding.

## FROM THE BUCKET LIST TO THE CLASSROOM

Throughout her career, Farrell has found ideas for her experiential teaching methods through some of her own personal likes and adventurous experiences. A lover of active vacations, she is not the type of person who would be spotted at a pool in Aruba. Instead, she and Cole swam and biked across the island of Mallorca in the Mediterranean Sea, cycled through Germany and Austria, and climbed a glacier in Norway. In August 2012, Farrell, joined by Cole and five friends, embarked on her boldest vacation adventure yet—a climb to the 19,340-foot-high summit of Mount Kilimanjaro in Tanzania, Africa. She returned to Rowan with inspiration for a truly unique class assignment.

"I would say the most interesting thing to me was the fact that you walk through so many different climate zones in a short period of time," says Farrell of their six-day hike with guides up the highest mountain in Africa. "You start out at the rain forest, and then you walk through every climate zone until you get to the peak, which is an arctic zone. Coming down is even faster; you do all of that in two days."

Those changes in climate zones and their impact on the body are part of what Farrell had her students explore in their Principles of Chemical Processes class, the first chemical engineering course that Rowan College of Engineering students in that field take.

"I have been using example problems and homework problems that are related to climbing Kilimanjaro," she says. "For this particular course, the concepts that apply have to do with the process of respiration.

"For example, an interesting calculation they can do is a mass balance on the lungs. That basically accounts for everything that goes in and out of lungs during breathing. They

*Stephanie testing biodiesel emissions with three graduate students from Kazakhstan who worked in her lab in 2012.*

can calculate the amount of water that is lost just through the process of breathing. On Kilimanjaro, it's really very different in different climate zones, with different humidities, different temperatures and different elevations and changes in atmospheric pressure, which all impact breathing."

What's next on Farrell's bucket list? "We were exhausted after climbing Kilimanjaro, so Peter jokingly threatened me with a beach vacation," Farrell says, admitting that although a warm beach vacation is not bucket list worthy, it could in fact inspire some new class assignments. "There's chemical engineering at the beach, too. Maybe we'll look at the aerodynamics of paragliding. We can find chemical engineering in everyday life, anywhere we go."

## FURTHERING ENGINEERING EDUCATION

Nearly 20 years after she attended her first ASEE meeting as a graduate student, Farrell continues to demonstrate an unwavering commitment to improving engineering education, through both her scholarly work and service to the profession. She has been an active member of ASEE for 15 years at both the section and national levels and has been elected twice to the Board of Directors, formerly as a Zone One chairperson and vice president of Member Affairs. She also is dedicated to advancing equality and inclusion of lesbian, gay, bisexual, and transgender (LGBT) engineers as a member of ASEE's Diversity Committee.

Farrell's contributions as an engineering educator have been recognized with national ASEE awards, including the 2001 Joseph J. Martin Award, the 2002 Ray W. Fahien Award, the 2004 National Outstanding Teaching Medal, and the 2006 Robert G. Quinn Award for experiential learning.

Internationally, Farrell serves on the executive committee of The International Federation of Engineering Education Societies (IFEES). Founded in 2006, IFEES plays a lead role in connecting the world's engineering education societies and leveraging their collective strengths to improve engineering education worldwide. She also is involved in the Indo U.S. Collaboration for Engineering Education (IUCEE) program that was conceptualized by more than 150 leaders of engineering education and businesses from the United States and India in 2007. Its aim is help create good quality engineering talent in order to find solutions to the global challenges facing humanity, such as energy, environment, health, and communications.

Of particular interest to Farrell in the global arena is the improvement of engineering education in Kazakhstan. She has made three trips to the Central Asian country during the last three years on behalf of Rowan and IFEES, lending her expertise and insight to issues such as academic mobility and international accreditation.

## FULBRIGHT SCHOLAR PROGRAM

Farrell's peripatetic efforts to advance engineering education around the world have brought her to Dublin, Ireland, for the 2014-2015 academic year. Selected as part of the prestigious Fulbright U.S. Scholars Program, Farrell was awarded a grant to conduct research on engineering education at the Dublin Institute of Technology (DIT). She was chosen as one of about 1,100 U.S. faculty and professionals to travel abroad during the year.

At DIT, her research is focused on the role of spatial visualization skills in improving the academic success and retention of engineering students. Farrell notes that spatial skills—the ability to visualize and understand objects in 3-D space—are directly correlated with achievement in many core areas of engineering study. "It was thought for a long time that spatial skills were an innate ability, but, in fact, they can be learned," she says. "In most cultures, there is a large gender gap in spatial skills, especially when you look at students at the college level. Since spatial skills can be taught, however, that gap can be closed." Farrell's research is aimed at answering important questions about the role of spatial skills in engineering education. Working with Farrell is a team of eight researchers who together are studying the spatial skills of approximately 1,000 students.

As part of the Fulbright program, Farrell also will work to bring visibility to her research and her host institution through several international trips, including stops at academic conferences in the United Arab Emirates, India, and Estonia.

When she returns to Rowan this fall, she hopes to use the experiences from her sabbatical in her teaching. When she enters the classroom, Stephanie Farrell aims to share something of herself with her students. For Farrell, that "something" goes well beyond engineering knowledge and professional skills. What she hopes to share most is a love of learning, the sharpening of curiosity, and the ability to see the world in unique and interesting ways. ❐