

BY JENNIFER BALDINO BONETT

# summer school with a *twist*

**E**ach summer, several hundred students bypass the lazy days at the Jersey shore and head to Penn's campus where students create robots and design digital models, debate technology in democracy and much more. With 11 summer programs, Penn Engineering annually welcomes students from middle schools, high schools and colleges around the U.S. and abroad for a summer of discovery. Some programs, like the highly popular Summer Academy in Applied Science and Technology (SAAST), offer the bonus of academic credit and the experience of collegiate life.

While an SAAST lunch-table conversation turned easily from Harry Potter to computer games to dorm life, high school students like Chris Rink of Marietta, GA, were serious about gaining college-level experience in engineering. "We're here to expand our horizons, to become more knowledgeable," said Rink, who studied computer programming. We're testing to see if we want to do this for the rest of our lives." Being in Philadelphia is also "cool," added the high school senior.

Across Houston Hall, students from SAAST's Technology and Democracy course were having lunch with their instructor, Bioengineering Professor Kenneth R. Foster. During their three weeks on campus, the students focused on social implications of technology through classroom instruction, including "a whole semester's worth of reading," notes Foster, "field trips to the U.S. Agency for International Development (USAID) and other non-profit organizations, and hands-on projects."

Joan Park, a high school sophomore in Woodbury, MN, joined SAAST to address important questions in her life: "How can I better prepare for college? How can I work more efficiently and effectively? Can I help make a change [in the world] right now?"

Effecting lasting change was part of the experience. Stephanie Takeuchi, a high school senior in Palos Verdes Estates, CA, was among the students who contributed to a project of Engineers Without Borders, using cell phone technology to give patients desperately needed access to a medical dispensary in Honduras. "There's really nothing like this offered in high school," she said.

In the General Motors Laboratory located in the Towne Building, SAAST students were designing semi-automatic robots. Amid bright copper-colored piping, spools of red wire, and tables strewn with tools and bits of metal, the students worked in groups to build robots on truck bases for an end-of-course competition.

As the sound of a classmate's hammering echoed through the lab, the students were focused on building the robot that could move through a maze more quickly and accurately than its competitors. "Aside from the thrill of competition, students leave the course with knowledge of basic robotics programming, mechanical tools and calculations," says David Cappelleri, doctoral student and SAAST instructor.

In the neighboring Moore Building, with the inspiration of ENIAC right outside their classroom, students in SAAST's Computer Graphics course were fashioning digital characters as diverse as a centaur, a man wearing Prada sunglasses, and a dragon. "In this course, we merge art and technology," says instructor Mark VanLangeveld. "Students come here from high schools all over the world where they are often frustrated by the lack of art or technology programs."

The course prepares students for collegiate programs in arts and technology. "As the entertainment industry and fields like architecture rely more heavily on digital media design," says VanLangeveld, "the field is growing enormously."

After intensive study of digital technology and human anatomy, each student creates a unique character, first through drawings and clay, then using digital technology. The goal is for students to have a good computer model or even animation by the end of the course.

"The students are so excited that they try to ditch field trips and work way into the night. I have to force some of them to take naps," says VanLangeveld, only half-joking. "By the end of the three-week course, we want the students to feel comfortable showing their work and talking to each other about it," he says. "It happens easily. These students are passionate."

So are the undergraduates in the Nano/Bio Interface Center (NBIC) summer program called Undergraduate Research at the Nanoscale. In labs throughout campus, seven students from the U.S. and Puerto Rico conducted hands-on research in this cross-cultural, multi-disciplinary program. Now in its third year, the NBIC program is a 10-week Research Experience for Undergraduates, funded by the National Science Foundation.

Faculty from Penn and the University of Puerto Rico collaborated to develop a rich research experience with a forward-looking professional development component on cross-cultural issues. The NBIC program is at the forefront of preparing students to work in multi-cultural scientific environments. Throughout the summer, students gain valuable experience in research early in their academic careers. "It's not only a resume-builder, it's an open door to a career in science," says NBIC Director Dawn Bonnell. "We want to develop a knowledge base in these students with hopes of encouraging them toward graduate school and careers in science and math. We hope that they'll be leaders in science and engineering and champions of diversity in those workplaces."

The excitement of working at the nano level—"the present and future in science"—intrigued Arelys Rosado Gomez of the University of Puerto Rico. The chemistry major worked with Dr. Bonnell in her research on the basis of property variations at atomic scales in complex materials.



In addition to significant lab experience, students also participate in professional development workshops and seminars led by experts at Penn's Greenfield Intercultural Center. Field trips included visits to Hispanic cultural centers in North Philadelphia with Penn's La Casa Latina and dinner at Latin American restaurant Isla Verde.

"These experiences were a great complement to the academic component of the program," said Evan C. Reed, a junior at The College of New Jersey. He worked on enhanced modeling and characterization of contour-mode piezoelectric resonators with Assistant Professor Gianluca Piazza of the Department of Electrical Systems and Engineering.

"The program certainly opened my eyes to the near-endless possibilities that nanotechnology offers," said Reed. "I expect that the program will help me decide whether I want to pursue a career in the biomedical engineering research industry or work in a clinical setting as an engineer or an MD."

The hope is that an early introduction to university research will entice more students on a career path in the sciences. In fact, the NBIC summer program is part of a larger Penn Engineering effort to strengthen the pipeline in the field. NBIC Program Coordinator James McGonigle oversees a similar effort at the high school level, working to increase science literacy through professional development of high school teachers.

### Meeting of the Minds

To succeed in computational neuroscience, one needs expertise in math, engineering and several of the sciences. "But students tend to come from one side or the other," explains Leif H. Finkel, professor of bioengineering. "We have been asking ourselves how students can get the skills for the cross-disciplinary study of computational neuroscience and how we can interest them in this exciting area."

To nurture the next generation of computational neuroscientists, Finkel and colleagues from the sciences at Penn are using a first-of-its-kind training grant from the National Institutes of Health to offer experience in computational neuroscience to undergraduates and pre-doctoral students. The first cohort of 15 students met during the summer for a six-week intensive program in the principles and techniques of this dynamic field.

For Lena Virasch, BE'08, the summer program built on interest kindled in Finkel's course in computational neuroscience and neuroengineering. "It turned out to be one of my favorite courses in my three years of college," she says. "I wanted to further explore that interest in a more hands-on and individualized setting."

The program is designed to integrate experimental and theoretical approaches to understanding neural function. Students learn to record electrophysiological signals from neurons, and then cull their data to explore and predict the behavior of single cells and networks using computer simulation techniques. These skills are then used in research rotations carried out under the supervision of neuroscience faculty.

During Virasch's lab rotation, she conducted research on modeling the volume diffusion of nitric oxide gas in the olfactory bulb with neuroscientist Alan Gelperin, a Penn alumnus, at the Monell Chemical Sciences Center in Philadelphia. Lectures and chalk talks support the lab experience. Virasch found the program's speaker series particularly valuable. "It enabled me to hear the personal paths of how researchers came into the computational neuroscience field," she says. "Although I am still thinking over my long-term plans . . . participating in this program has definitely made me consider graduate study in computational neuroscience."

As Virasch and her fellow students left the Penn Engineering campus at the end of their programs, they carried with them unique replies to the big September question: "What did you do over the summer?" Perhaps they even left knowing how they want to spend their lives. ▾

### Summer at Penn Engineering

Penn Engineering hosts 11 programs to give college, high school, and middle school students experience in engineering and the applied sciences. Some programs are held only in summer; others—like the computational neuroengineering program—are year-round.

**Summer Academy in Applied Science and Technology (SAAST)** A three-week intensive program for high school students / *Contact Christine Brisson* [brisson@seas.upenn.edu](mailto:brisson@seas.upenn.edu)

**Summer Institute in Business and Technology (SIBT)** A four-week program for international college students, hosted jointly with the Wharton School / *Contact Megan Doherty* [megand@seas.upenn.edu](mailto:megand@seas.upenn.edu)

**Management and Technology Summer Institute (M&TSI)** An intensive, three-week program for rising high school seniors, hosted jointly with Wharton / *Contact Lea Engle* [lengle@wharton.upenn.edu](mailto:lengle@wharton.upenn.edu)

**Computational Neuroengineering Program** A training program for undergraduates interested in research in computational neuroengineering / *Contact Leif Finkel* [leif@neuroengineering.upenn.edu](mailto:leif@neuroengineering.upenn.edu)

**Science Projects Are Right for Kids! (SPARK)** An introduction to science and technology for Philadelphia school students in grades 4 through 8, funded by a grant from the National Science Foundation and in cooperation with Penn's Graduate School of Education and Social Work Policy and Practice. / *Contact Sonya Gwak* [sgwak@seas.upenn.edu](mailto:sgwak@seas.upenn.edu)

### Research Experiences for Undergraduates

**SUNFEST (REU)** A undergraduate fellowship program in sensor technologies / *Contact Jan Van der Spiegel* [jan@seas.upenn.edu](mailto:jan@seas.upenn.edu)

**Materials REU** A program for undergraduates interested in materials science and engineering / *Contact Drew McGhie* [mcghie@rsm.upenn.edu](mailto:mcghie@rsm.upenn.edu)

**Nano-Biotechnology Interface REU** A program for undergraduates that combines a rich research experience in nanobiotechnology with structured professional development focused on cross-cultural issues / *Contact Jim McGonigle* [jmcgon@seas.upenn.edu](mailto:jmcgon@seas.upenn.edu)