

Dartmouth undergrads who are considering careers in science have a chance to “apprentice” themselves to mentors at DMS and actually sample the culture of life in a lab. Here is a look at several such pairings—through the eyes of two undergraduates who took on apprenticeships of a different sort.



Undergraduates Lauren Wool, left, and Vanessa Hurley, right—pictured here in Dartmouth’s Baker Library—photographed and interviewed fellow undergrads for this feature. Each is holding the tool she used—Wool a digital camera and Hurley a digital recorder.

Donald Trump has given the word “apprentice” a bad name. The practice forged in the medieval era, of learning a craft in the atelier of a master, is alive and well at Dartmouth—sans the viciousness of Trump’s reality TV show *The Apprentice*, on which young contestants vie for a chance to run a company owned by the business magnate. However, the Dartmouth undergraduates who’ve had a chance to “apprentice” in Dartmouth research labs are just as eager as the TV contestants to show they’re talented and committed. And Dartmouth faculty members—at the Medical School, as well as in the undergraduate science departments and at the Thayer School of Engineering—are eager to welcome undergrads into their labs.

Working in labs gives students “real-world experience [in] all the things that go with research—the fruits, the perspiration, the re-experimentation,” says Lee Witters, M.D., a DMS endocrinologist and the faculty advisor for the Nathan Smith Society, an organization for Dartmouth undergraduates who are interested in careers in medicine or health. A lab experience, he adds, “opens [students’] eyes to the opportunities and possibilities” in research.

The benefits are both pragmatic and philosophical. Working in a lab “can help [students] determine whether they want to do research as a career,” points out Margaret Funnell, Ph.D., assistant dean of the faculty for undergraduate research. Undergraduates also often forge a bond with the faculty member, “who can be a mentor and guide students as they make academic and career decisions.” And, she adds, experience doing research is always a plus and is sometimes required when students apply to graduate or medical school.

It can be a plus for faculty, too, to have undergraduates in their labs, says Mary Pavone, director of Dartmouth’s Women in Science Project (WISP). “The benefit to faculty,” Pavone explains, “is that they can

As it happens, two DARTMOUTH MEDICINE “apprentices”—pictured on the facing page—were integral to the production of this feature: senior Lauren Wool, on the left, took the photographs and junior Vanessa Hurley, right, interviewed the students.

Wool was the photo editor last year of the undergraduate newspaper, *The Dartmouth*, and the editor this year of a monthly newsletter put out by WISP. She also held a work-study position at DARTMOUTH MEDICINE from the second term of her first year through the final term of her senior year; in addition to transcribing interviews and helping maintain the magazine’s index and digital image database, she has taken photographs several times for these pages and even wrote an article for this issue (see pages 12 and 13). Wool, who majored in neuroscience, graduated this June and plans to pursue a career in website design, magazine publishing, and photography.

Hurley, who spent the spring term as DARTMOUTH MEDICINE’s editorial intern, has written several other articles for this issue (see pages 7, 14, and 22). She was drawn to the internship as a chance to integrate her interest in both science and writing. Hurley just completed her junior year and is majoring in English while also completing the premedical requirements. After graduating, she plans to go into medicine and/or science journalism.

In addition, both Wool and Hurley have themselves worked in research positions at Dartmouth. “The benefits of working in a lab are the relationships that you create,” says Wool, who worked for a year and a half with a researcher in the College’s Department of Psychological and Brain Sciences. The challenge, she adds, is that “lab work requires a lot of patience, and it is immensely frustrating not to get [immediate] results. But overall, it makes you better at paying close attention to details and helps enhance your critical-thinking skills.”

The Apprentices

Photographs by Lauren Wool Text by Laura Stephenson Carter and Vanessa Hurley

be refreshed and rejuvenated by working with young students and have the satisfaction of knowing they have influenced them in some positive way about a science career.”

National studies have shown that “undergraduate research enhances the educational experience of science undergraduates,” noted a 2004 paper in *Cell Biology Education*. At Dartmouth, some undergrads are so interested in such experiences that they volunteer in labs. But many undergraduate research positions offer stipends, which come from alumni donors, foundations such as the Howard Hughes Medical Institute, corporations, federal agencies, and other sources.

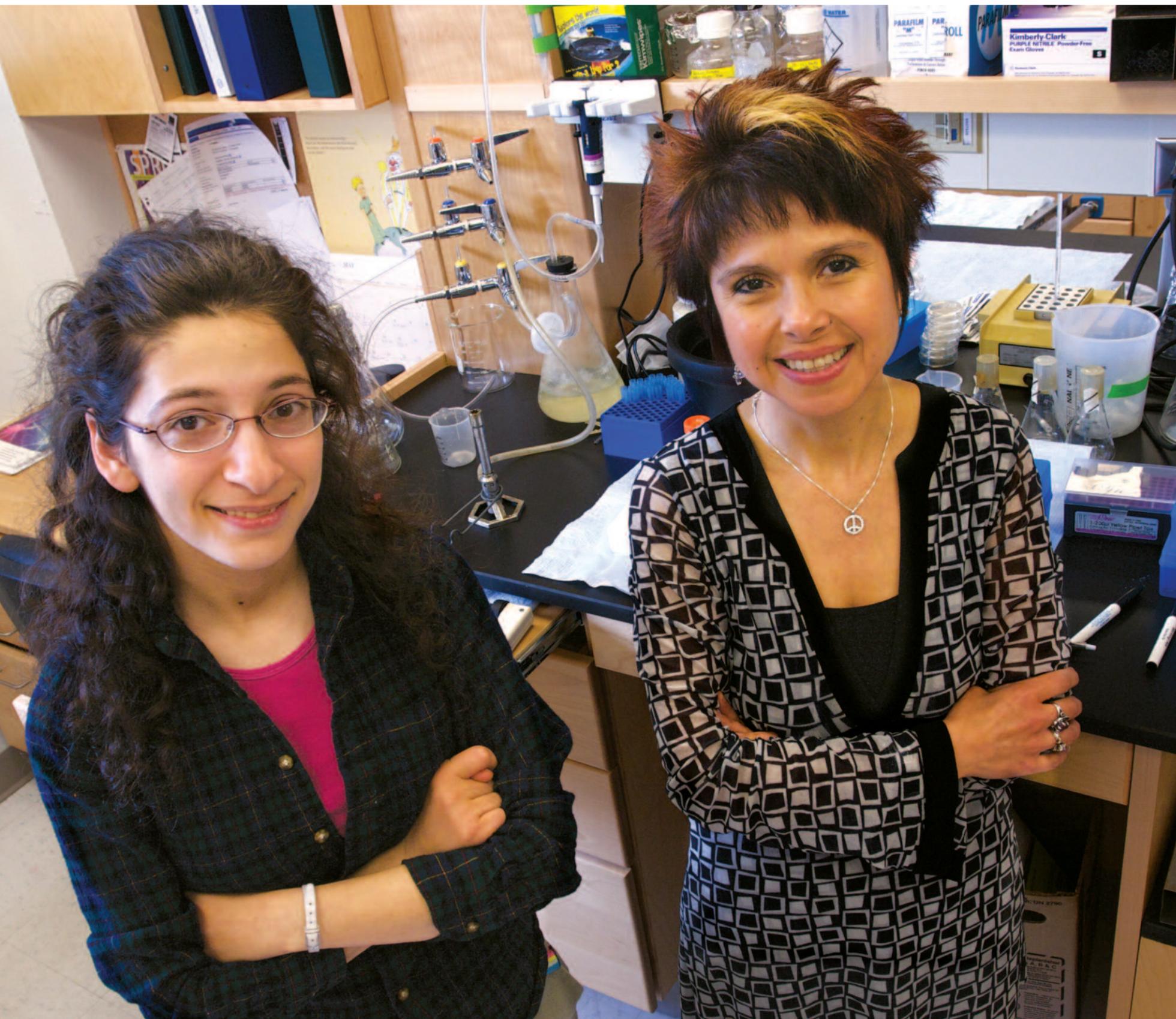
On the following pages is a glimpse of four “apprentice” researchers and their faculty mentors, and at how the experience has enriched (and challenged) them. The Q&A text has been edited lightly from interviews conducted with the students and the faculty members.

Laura Carter, the associate editor of DARTMOUTH MEDICINE magazine, wrote the introductory text on this page. Also playing key roles in this feature were the two Dartmouth undergraduates pictured on the facing page: Lauren Wool '08, who majored in neuroscience and worked in the magazine’s offices all four years at Dartmouth, and Vanessa Hurley '09, a premed English major who spent the spring term as DM’s editorial intern.

Hurley’s research experience involved working on two clinical research projects at the Children’s Hospital at Dartmouth during her first and second years at Dartmouth. One study looked at how long women who delivered babies at DHMC continued to breast-feed their infants, and the other examined hepatitis B vaccination rates. “I wanted a chance to work on a project that was more clinical in nature—sort of the human side of medicine,” explains Hurley.

It’s impossible to pin down exactly how many undergraduates over the years have worked in labs, since the experiences are arranged under many different auspices—including WISP, the Office of Undergraduate Advising and Research, and the Student Employment Office. But the total is clearly well into the thousands.

Even students who decide not to go on in science get something out of such experiences. “I think the benefits of research go well beyond simply preparing someone for a research job,” says Assistant Dean Funnell. “The skills students learn doing research are skills that translate into many other jobs: thinking critically, drawing evidence-based conclusions, and communicating findings and opinions.”



The scientist: Yolanda Sanchez, Ph.D. (right)
Her title: Associate Professor of Pharmacology and Toxicology
Joined the faculty: 2006

What qualities do you look for in undergrads for your lab?
 Drive, curiosity, and maturity.

What are the benefits of having undergrads in your lab?
 I really enjoy undergraduates. Training them is an important part of our jobs—we're recruiting the next generation of scientists. It's fun to see how they view the world—they're blank slates, full of ideas, and not cynical, which is nice. One of the most appealing things to me about coming to DMS was that there were mechanisms for undergraduates to pursue research.

Did you work in a lab when you were an undergrad?
 I did an honors thesis at the University of Texas at El Paso. I had an undergraduate fellowship to look at small organelles in water molds that were a nuisance for ponds.

What are the challenges of having undergrads in your lab?
 It takes time to train them, but it's one of the most rewarding things we do.

Is there anything else you'd like to add?
 I think that working in research labs is a very important formative experience for students interested in pursuing a career in science. We need more young people to join the scientific community. If nothing else, as voters, they'll be more informed about where money for research is going.

The student: Rachael Labitt '11 (left)
Major and minor: Biology and Chinese
Hometown: Nashua, N.H.
Joined the Sanchez lab: Fall 2007

What are your career goals?
 I'd like to take a few years off after graduating and then apply to veterinary school.

What got you interested in science?
 I've always been fascinated with living things—amazed by their complexity and by the fact that despite the myriad layers of complexity everything manages to work the way it's supposed to.

What drew you to the Sanchez lab?
 I wanted to get experience in a laboratory setting. I had never worked in a real lab. I found out about the position through Jobnet, which I guess you could say is Dartmouth's online classifieds.

Then I looked at the lab's website, and although I could barely understand any of it, it looked cool and the people looked happy.

What's the most exciting aspect of the research process?
 When things work. I'm looking forward to the next couple of weeks, when we will start looking at mouse tissues to see what effect the genes have on the embryo's development.

What is the most difficult part of doing research as a student?
 It takes up a lot of time. Also, you realize you don't really know much of anything, though that could be seen as a good thing, too. There's always more to know, and you can never know everything. But if you don't know things, you can always learn. And as any institution of learning would tell you, learning is not a bad thing.

What is the quality you most admire in people?
 Perseverance.

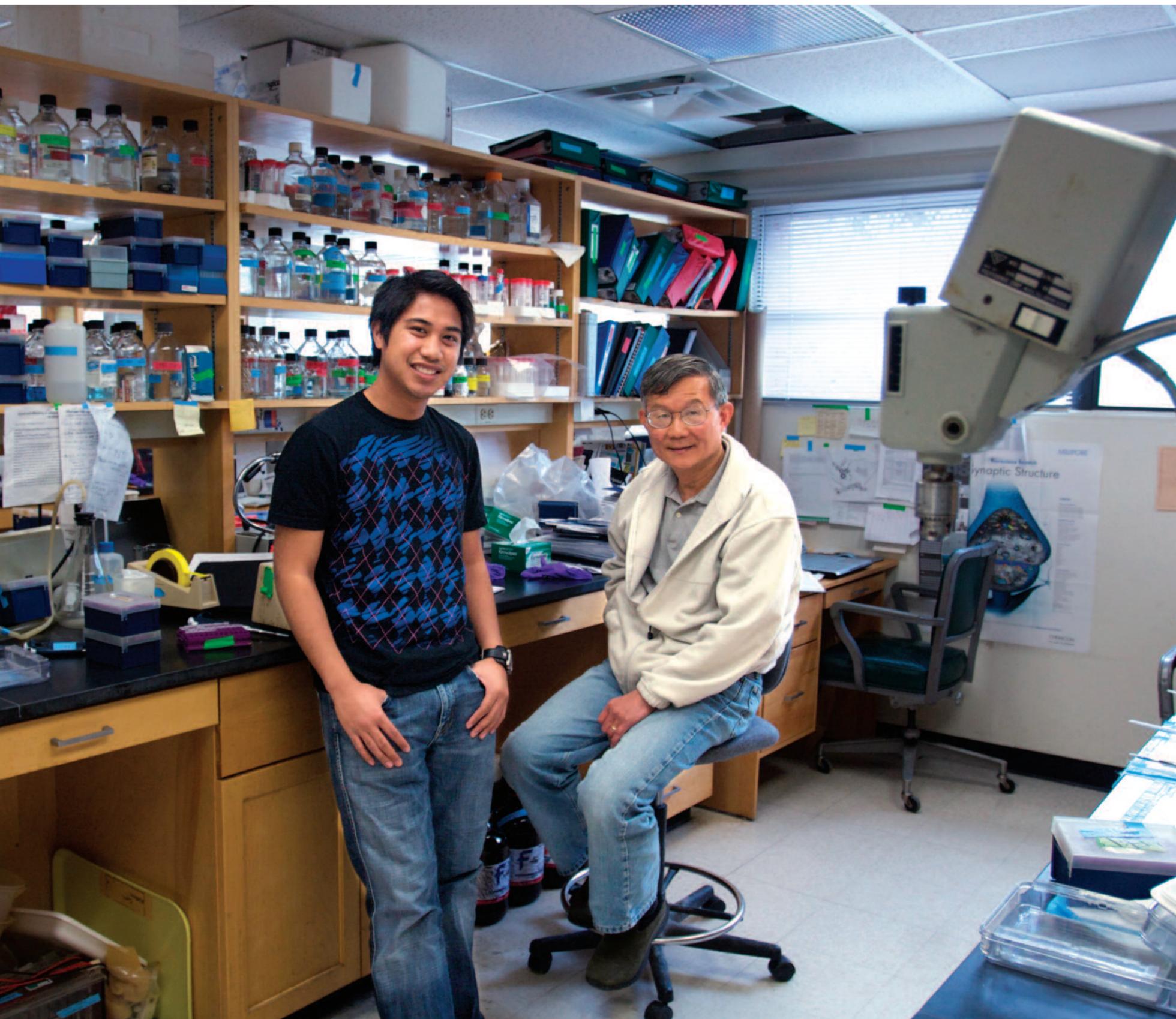
What about you surprises others?
 I've lived in New Hampshire my whole life but have never been to Canada.

What are your interests outside of school and work?
 I'm interested in dance. I did ballet and modern dance in high school. I also volunteer at a vet clinic on weekends, I started taking horseback riding lessons, and when the weather is warm I help out at the Dartmouth organic farm.

What kind of music is on your iPod (or CD player) right now?
 A mix of things—Nirvana, Enya, Beatles, Bare Naked Ladies, piano music, Toad the Wet Sprocket (a great name), some Chinese classical music, and the *Lion King* soundtrack.

Finish this sentence: If I had more time I would . . .
 Take dance classes. Draw. And read and learn things other than for my classes.

The laboratory: Sanchez has had "at least four" undergrads in her lab since coming to Dartmouth. She studies signaling pathways that regulate cell division, DNA repair, and cell death and their role in the origin and treatment of cancer. Labitt is investigating a protein that may be the Achilles heel of cells in the process of becoming cancerous. She is looking at a kinase (an enzyme) called Chk1 that stops cell division when DNA is damaged; some people have a mutation in Chk1. Part of her work involves "preparing and staining many, many slides to see if we can determine what exact effect the mutant Chk1 has" on cells.



The scientist: Ta Yuan “T.Y.” Chang, Ph.D. (right)
His titles: Professor and Chair of Biochemistry
Joined the faculty: 1976

What qualities do you look for in undergrads for your lab?
 Good GPAs, some previous lab experience, and an interest in doing research. I also like to have students who are involved in sports and/or music.

What are the benefits of having undergrads in your lab?
 Dartmouth undergraduates are usually smart and energetic but down-to-earth in spirit. Those who come to our lab are usually curious about research. These traits usually make them lively and courageous lab members.

Did you work in a lab when you were an undergrad?
 Yes, in an organic chemistry lab in National Taiwan University. I did extraction, purification, and structure determination of natural products present in the leaves of a plant. That experience made me realize that I had a passion for research.

What are the challenges of having undergrads in your lab?
 It takes time and effort to work with undergraduates. Fortunately, my wife, Cathy, who has been a senior research associate in my lab for almost 30 years, is a great teacher. She has helped to train all the undergraduate and graduate students and fellows and has been very patient and kind to them. The biggest reward has been that almost all of the undergraduates who trained in our lab have gone on to receive M.D. or M.D.-Ph.D. degrees. A few have become faculty members in major medical schools. Others have become physicians.

The student: Floyd Buen '09 (left)
Major: Biology, with a focus on biochemistry
Hometown: Santa Clarita, Calif.
Joined the Chang lab: Fall 2006

What are your career goals?
 I want to pursue a career in research, maybe through an M.D.-Ph.D program. After I graduate I plan to work for a year or two, maybe at a hospital or for a nonprofit organization or the World Health Organization. I definitely want to go out of the country—maybe to the Philippines.

What got you interested in science?
 I always had exposure to science. I got my first microscope when I was in elementary school. In high school, I had advanced placement biology with a phenomenal teacher. Every student in our class loved her and learned successfully from her. I guess she inspired me to take an interest in science.

What drew you to the Chang lab?
 I really wanted to learn the lab techniques because after class, you don't always understand how every single thing works, no matter how much the professor explains it to you. I wanted to have a hands-on experience and learn for myself.

What is the most difficult part of doing research as a student?
 Time and patience. It's difficult to juggle your schoolwork and extracurricular activities with lab time because some experiments take the entire day. And you're always hoping for an experiment to work, and the majority of the time it doesn't.

What is the quality you most admire in people?
 I admire people who are hardworking, goal oriented, intelligent, and, most important, human. To be intelligent is one thing but to be kind, compassionate, and willing to have fun is admirable.

What about you surprises others?
 I come from a huge family, even though I have only one sibling—a younger sister. But both my parents come from really big families. At one family reunion, one of the emcees said my dad has 72 first cousins just on his mom's side. I don't know if they were joking, but I'd certainly believe it. Family is the most important thing in my life.

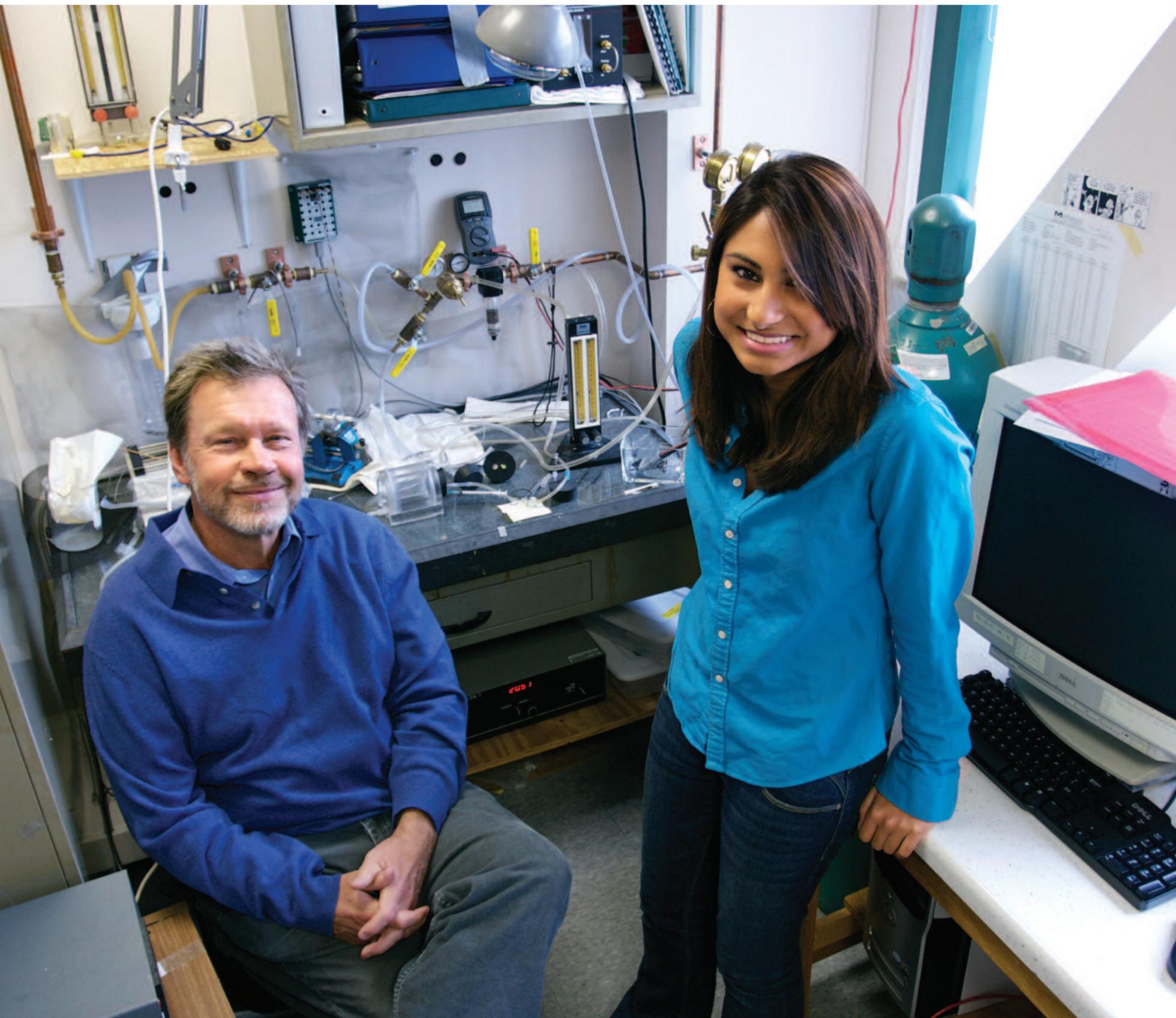
Do you have any hidden talents?
 I can move my eyes from side to side freakishly fast.

What are your interests outside of school and work?
 I love to play piano and hang out with my family.

What kind of music is on your iPod (or CD player) right now?
 I really like Musiq Soulchild and John Legend. I have classical. I have Edvard Grieg. I have Jack Johnson, Red Hot Chili Peppers, Guster. I have some hip hop. I have Beatles. I have a lot of my parents' old stuff, like Journey, the Eagles. I don't have a lot of country, though.

Finish this sentence: If I had more time I would . . .
 Learn more languages. I want to learn Mandarin, French, Japanese—those are my top three—and then Italian and, down the road, German. I would also spend more time with my family.

The laboratory: Chang has had undergraduates in his lab for 31 years—more than 35 of them in all. The lab studies cholesterol regulation at the cellular and molecular level. Buen has been helping to analyze the effect of genetic inactivation of the enzyme ACAT1 on the progression of Alzheimer's disease in a mouse model.



The scientist: Eugene Nattie, M.D. (left)
His title: Professor of Physiology
Joined the faculty: 1975

What qualities do you look for in undergrads for your lab?
 Interest, enthusiasm, and dedication.

What are the benefits of having undergrads in your lab?
 Dartmouth students are very bright and dedicated. They work hard and reliably. They ask great questions, often ones that I have not thought of.

Did you work in a lab when you were an undergrad?
 I did sociology research with Dartmouth Professor Derek Phillips. I correlated the geographical distribution of mental illness with so-called psychosomatic diseases. This gave me my first inkling that I could be an academician and scientist.

What kind of work do undergrads do in your lab?
 We usually assign a specific task to each student. They repeat the task until they are proficient. Most students learn this quite quickly.

Is there anything else you'd like to add?
 Having undergrads in my lab has been a highlight of my career. Dartmouth students have many interests—sports, music, dance, art—and it's fun to learn about them. Undergrads bring an enthusiasm and spirit that adds to the life of the lab.

The student: Shima Dowla '11 (right)
Major and minor: Neuroscience and Arabic
Hometown: Lexington, Ky.
Joined the Nattie lab: Fall 2007

What are your career goals?
 After I graduate, I intend to take a year off before medical school—I would like to spend time in my parents' home country of Bangladesh. I hope to become a neurologist like my uncle.

What got you interested in science?
 Because my parents are chemists, I was introduced to science at a very young age. By the time I was in middle school, I had a strong interest in biology and a strong dislike for physical inorganic chemistry (much to my parents' dismay). Neuroscience explains to me why I am the way I am. College is supposed to be a time for self exploration. What better way to understand yourself than to dig into your brain?

What drew you to the Nattie lab?
 After doing a research project in high school, I realized I wanted to continue research in college.

Last summer I came across a student position in Dr. Nattie's lab, and after talking to a number of mentors I realized that this was the right place for me. It is a small, encouraging environment with a great group of people.

What is the most difficult part of doing research as a student?
 Finding time. I have had difficulty allotting large amounts of time to research because of the amount of studying I must do to keep up with my classes as well as my extracurricular activities.

What is the quality you most admire in people?
 Trustworthiness. As much as I admire the ingenuity of Einstein and the creativity of Mozart, I feel that trustworthiness is very important in order to build strong and lasting relationships.

What are your interests outside of school and work?
 I am a choreographer for Indian hip hop dances for a variety of shows, teach dance lessons to children in the Upper Valley, play club tennis, and am involved with the International Humanitarian Foundation. Right now, we are fund-raising for a trip to Ecuador this summer to work with children in Yambiro on English and public health.

What about you surprises others?
 My interest in language and different cultures, because I am a science-oriented premed. I have family in many different parts of the world, so I'm interested in interacting with people from all over. I can speak, read, and write fluently in English, Bangla, and Arabic. Hopefully I will become fluent in Spanish after my service trip to Ecuador this summer, and I'm still learning Hindi!

Do you have any hidden talents?
 If you let me listen to a random song, I can pick up its melody and play it on the piano.

What kind of music is on your iPod (or CD player) right now?
 An Indian hip hop song. I usually choreograph on the way to class, at the gym, whenever I have a little bit of free time.

Finish this sentence: If I had more time I would . . .
 Travel the globe!

The laboratory: Nattie, a DC '66 and DMS '68, has had undergrads in his lab since 1975—at least 90 over the years. He studies the role of the brainstem in regulating breathing and blood pressure. Dowla is looking at breathing and heart-rate responses to reflex breathing inhibition in rats as part of a study of sudden infant death syndrome.



The scientist: Joyce DeLeo, Ph.D. (right)

Her titles: Irene Heinz Given Professor of Pharmacology and Toxicology and of Anesthesiology; Director of the Neuroscience Center

Joined the faculty: 1989

What qualities do you look for in undergrads for your lab?

I set a high bar. I interview each candidate to make sure they are truly interested in research—versus a short experience for medical school applications—and are committed to the time it takes both technically and intellectually. I ask what other activities they're involved in to gauge their ability to spend quality time in the lab.

What are the benefits of having undergrads in your lab?

We are very fortunate to have the opportunity to work with undergrads, graduate students, post-docs, junior faculty, etc. Each group brings a distinct enthusiasm and passion to our research.

Did you work in a lab when you were an undergrad?

I had a limited experience doing literature searches for biology professors. I attended a large New York state school, SUNY at Albany, where there were few opportunities to do actual research. Dartmouth undergrads are lucky to be exposed to labs where they can actually contribute, and we're lucky to have such stellar students to work with!

What are the challenges of having undergrads in your lab?

I thoroughly enjoy mentoring students if they are motivated and committed. Challenges arise if there is a disconnect between the principal investigator's and the student's expectations. Some undergrads are overcommitted with other activities. Research is very expensive; this is not like an organic chemistry lab where we know the answer before doing the experiment.

The student: Matthew Alkaitis '09 (left)

Major: Biology, with a focus on human biology

Hometown: Arnold, Md.

Joined the DeLeo lab: Summer 2007

What are your career goals?

After I graduate, I plan to take a year off to travel the world with two of my best friends from Dartmouth. Eventually, I hope to enter medical school or an M.D.-Ph.D program.

What got you interested in science?

When I was young I loved nature and the outdoors. I think this translated into a fascination with the precision and complexity of living systems and led me to study science and medicine.

What drew you to the DeLeo lab?

After interviewing with Joyce DeLeo, I could tell that the level of expertise and general friendliness she and the other members of her lab brought to the table would make it a worthwhile experience.

What's the most exciting aspect of the research process?

Presenting and discussing results and ideas. Dr. DeLeo has worked hard to give me opportunities to discuss experimental design, present data to the lab group and at Dartmouth's Neuroscience Day, coauthor a manuscript, and edit others; she even walked me through the peer-review process.

What is the most difficult part of doing research as a student?

Time-management. Research is time-intensive and it's been a challenge to work it into my other activities. But it's an enormous blessing to have access to this experience. One of Dartmouth's strengths is its undergraduate focus, but the graduate schools give us fantastic opportunities as an integral part of our undergraduate education.

What is the quality you most admire in people?

Sincerity. Those who approach their lives and work from a place of sincere interest not only accomplish great things but really enjoy themselves.

What are your interests outside of school and work?

I've played on the Dartmouth rugby team since I was a freshman. I also play pick-up soccer, hockey, and lacrosse, and I snowboard and skimboard. On a random note, I'm a huge dog-lover. I'm also involved in MEDLIFE, a great nonprofit—founded by DMS student Nick Ellis—that helps low-income families in Ecuador get medical care. I am also a tutor for Dartmouth's Research, Writing, and Information Technology program, which has taught me a great deal about working with others.

What kind of music is on your iPod (or CD player) right now?

One of my current favorites is the band MGMT. In general, I'm a classic rock fan. My favorites include Jimi Hendrix, the Beatles, Simon and Garfunkel (and Simon alone), and Led Zeppelin. I'm also becoming a fan of jam-style music like Phish.

Finish this sentence: If I had more time I would . . .

Get involved with the Dartmouth Outing Club.

The laboratory: DeLeo has had 10 undergrads in her lab. She studies the neuroimmunology of chronic pain, with the aim of identifying novel targets for pain relief. Alkaitis has set up cell-based assays to screen agents that may modulate glial cells, supporting cells of the nervous system. ■