# The Promoter

Winter 2010 No. 12

Our department has grown and undergone exciting changes during 2009. An international search is underway for a new Director of the Pittsburgh NMR Center for Biomedical Research. Professor Chien Ho has led this center since its inception in 1986, through many years of extraordinary funding and research. The new Department of Computational Biology was formed and headed by Professor Bob Murphy.

Biological Sciences undergraduate students continued to set very high standards. We were proud to have a Fulbright Scholar and Goldwater Scholar, as well as a Rhodes Scholarship finalist and Goldwater finalist. Heather Chalfin won the Mellon College of Science Monterverde Award for the graduating woman with the greatest academic and professional promise. Sharon Briggs received an American Society for Microbiology Undergraduate Research Fellowship.

For the fourth year in a row, the Biological Sciences Student Advisory Council (BioSAC) raised the most money ($9,000) among the participants in the Relay for Life for cancer research. BioSAC also created an inspiring carnival booth, "Voyage of the HMS Beagle," in honor of Darwin's 200th anniversary. Another event held during carnival was the dedication of the Elizabeth Jones Undergraduate Lounge. Furthermore, we welcomed a new instructor for the undergraduate laboratory courses, Dr. Nina DiPrimio, and Professor Aaron Mitchell took over as Director of our Howard Hughes Undergraduate Science Education Program.

This year, a record number of 32 students matriculated to our M.S. and Ph.D. programs. Melissa Witzberger received an honorable mention for the Carnegie Mellon University Graduate Student Service Award. Jeanne Morin-Leisk and Ken Hovis were awarded the Departmental Graduate Student Teaching Award and Graduate Student Service and Outreach Award, respectively.

We also celebrated the many accomplishments of our faculty. Associate Professor Peter Berget received the Julius Ashkin Award for Excellence in Teaching in recognition of his many years of inspired teaching in both the classroom and laboratory. Associate Professors Alison Barth and Brooke McCartney were named Eberly Family Career Development Professors for their significant accomplishments and future promise. Associate Professor Nathan Urban was awarded the Association for Chemoreceptor Sciences Young Investigator Award for Research in Olfaction. Barth also received the Humboldt Foundation Bessel Research Award to support her upcoming sabbatical at the Bernstein Center for Computational Neuroscience in Berlin.

Last, many alumni reported significant milestones in their lives and careers *(p. 7-8)*. To let us know what you are doing, visit http://apps.bio.cmu.edu/alumnDB/.

John Woolford

John Woolford, Ph.D.
Acting Department Head

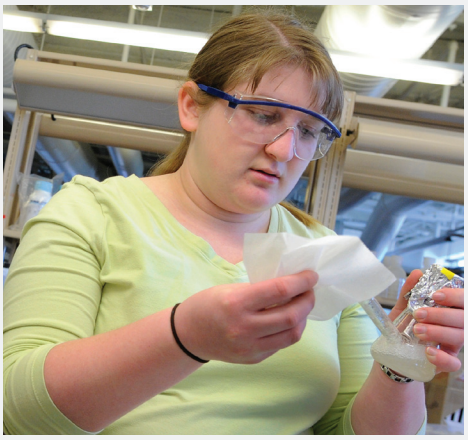
# Finding Fulfillment through Phages By Lianne Cohen, *Class of 2012*

When I heard that Carnegie Mellon was offering a research course to first years, I jumped at the chance to obtain hands-on laboratory experience. Through the Phage Genomics Research course, students isolated bacteriophages – viruses that infect bacteria – then used wet lab and computational techniques to characterize the phage.

The class quickly became my favorite as I learned the basics of bacteriophage research during the first few sessions. When the class connected wet laboratory information with sequence data, the research took on another level of meaning for me. Additionally, the most exciting and frustrating experience occurred on the last day of class. An immunity test returned surprising results: the lysogens of Che9c, a Group I phage, were immune to all Group I phages including our phage despite low sequence similarity. I felt that we had just begun and had so much more to learn and investigate when the year came to a close.

I was lucky, however, to be chosen to present our research to representatives from the Howard Hughes Medical Institute and Science Education Alliance as well as other students and professors at the National Genomics Research Initiative's First Annual Symposium on June 21, 2009, in Ashburn, Virginia. While meeting the other students, I realized that we faced similar challenges isolating phages, yet loved the discoveries we made and began to feel part of a community.

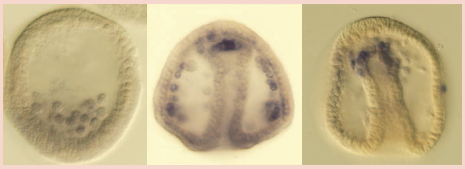
Through Phage Genomics, I gained some of my closest friends as well as the confidence to contribute not only to the Department of Biological Sciences, but also to the greater scientific community.



Lianne Cohen, a member of the 2008 – 2009 inaugural Phage Genomics Research course.

The course reinforced my interest in a career in research and provided me with even more research opportunities. I realized that I truly belong at Carnegie Mellon.

# Celebrating Evolution By Alys Cheatle, *Second-year Ph.D. Student, Hinman Laboratory*



*In situ* photos of sea urchin embryos.

Dost thou love life? Then do not squander time; for that's the stuff life is made of.
– *Benjamin Franklin*

Ask any biologist to name the "stuff" of life and most will probably list DNA, proteins, membranes and other scientific building blocks. But for us evolutionary biologists, the key component may well be time. Vast amounts of time led to the astounding diversity of life on our planet, from the numerous types of single-celled organisms to multi-cellular plants and animals.

In the Department of Biological Sciences, members of Veronica Hinman, Chuck Ettensohn and Dannie Durand's labs have been working to deepen our understanding of this diversity and the evolutionary process.

In Hinman's lab, we combine evolutionary and developmental biology approaches in a discipline nicknamed "evo-devo." Developmental programs of two echinoderms, sea urchins and starfish, are compared to ascertain how these animals have evolved to have different body plans. Recent work in our lab has shed light on how starfish embryos specify endomesoderm and neuronal cells, how microRNAs play a role in development, and how echinoderms may have obtained pigment genes from endosymbiotic bacteria.

Additionally, the Hinman and Ettensohn labs study the process by which sea urchin embryos have become capable of producing a larval skeleton, while their starfish cousins have not. The Ettensohn lab seeks to determine which genes are most crucial to regulating this process, while the Hinman lab investigates how these genes compare to their starfish equivalents.

In the 150 years since Charles Darwin published *The Origin of Species*, evolutionary biologists have studied the diversification of life on a level that Darwin surely could not have imagined. Not only is evo-devo allowing us to analyze how life evolved at the molecular and genetic level, but computational biology is also allowing us to ask new questions about the mechanics of evolution. In the spring of 2009, an evolution-themed computational biology symposium hosted by the department demonstrated the discipline's potential for providing novel insights. The work conducted in Durand's lab realizes much of this potential: her lab uses computational techniques to learn how gene duplication and diversification events have allowed organisms to become more complex during the course of evolution. Through the work from the Hinman, Ettensohn and Durand labs, the Department of Biological Sciences is making many contributions to determining how life has been shaped by time.

# Joining the Professional World By V. Emily Stark

Clockwise from the top left: Donghun Lee; Josh Earl; Kai Huang; Parul Nisha with her family; Jessica McGillen.

"Where do your graduates end up?" This candid question, posed frequently by prospective graduate students, really probes the success rate of our alumni: do they have what it takes to succeed in the professional world of science? Do we do our jobs as educators? It also interrogates our department's commitment to the academy and its research mission, our flexibility in embracing "alternative careers," and our values as global citizens.

Answering this question takes time: there are anecdotes to tell, numbers to float, assumptions to explain, and, of course, pie charts to display. But a snapshot of first professional positions taken by recent alumni does illuminate trends.

First, pie chart #1. Not surprisingly, most of our newly minted Ph.D. graduates choose to pursue academic postdoctoral training, successfully landing positions at lauded institutions such as Princeton University, the Salk Institute, the University of California-San Franciso, and the various National Institutes of Health. Representing this path is Parul Nisha, Ph.D. 2007, who currently works at the National Institute of Diabetes and Digestive and Kidney Diseases in the Laboratory of Cellular and Developmental Biology, where she is investigating the role of RNA silencing machinery on the function of chromatin insulators.

On the other hand, eager to apply their training immediately, some graduates eschew postgraduate work and seek positions in industry or government directly after graduation. Nan Song, a 2006 graduate from the lab of Dannie Durand, accepted a position as research scientist at Precision Therapeutics, Inc., where she applies her knowledge of computational biology to personalized medicine. Song explains her path: "I chose industry because I wanted to see the application of research in people's lives." Another Ph.D. graduate from computational biologist Robert Murphy's lab, Kai Huang, has moved from Carnegie Mellon to Credit Suisse Group, then to hedge funds SAC Capital, DE Shaw, and most recently Balyasny Asset Management, where he now works as a portfolio manager of Greater China equities. As Huang contends, "Without the advanced education I received at CMU, I would never be able to think independently about this complicated world."

Encouraged by a renewed emphasis on strengthening our students' teaching skills, most recently represented by the new Sciences Teaching Club, some students now confidently pursue teaching jobs. And a few have taken their talents back to school, working on degrees in medicine, veterinary science, and business.

Continuing their education is also a goal of many of our M.S. in Computational Biology graduates, although most prefer to find industrial positions for a few years to gain real-world experience before venturing back into academia. See pie chart #2.

For example, Josh Earl, who just graduated this past December, has been named Director of Bioinformatics at the Center for Genomic Sciences at Allegheny General Hospital where he worked as a computational biologist during a summer internship and while finishing up course-work. Josh credits his success: "Being a graduate of Carnegie Mellon opened many doors which I feel would have been inaccessible otherwise."

A smaller but growing group of M.S. graduates is continuing doctoral training in the sciences, chosen by selective programs at universities such as Oxford, Princeton, and Columbia. We like to think that a generous taste of rigorous and exciting scholarship at Carnegie Mellon whets these students' appetites for further education. Jessica McGillen, M.S. 2008, stated, "I came to Carnegie Mellon's Master's in Computational Biology program because

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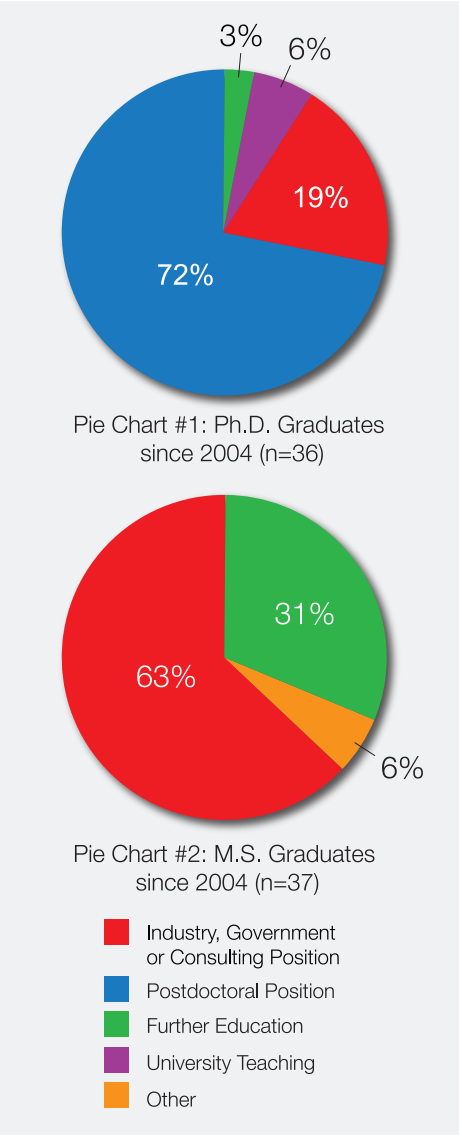
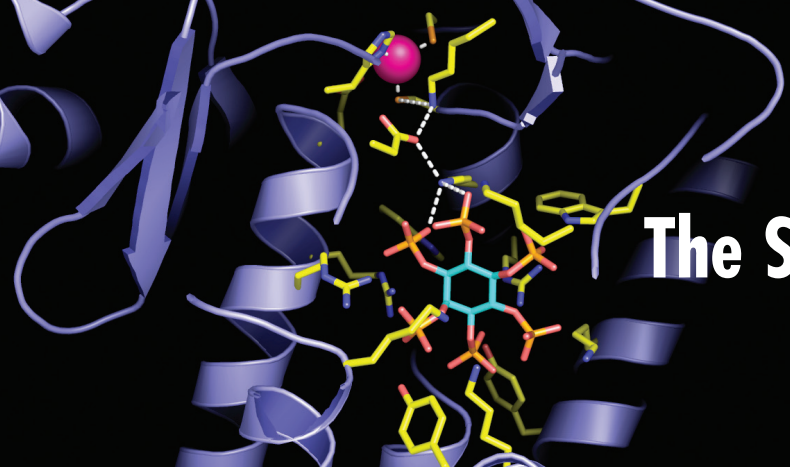


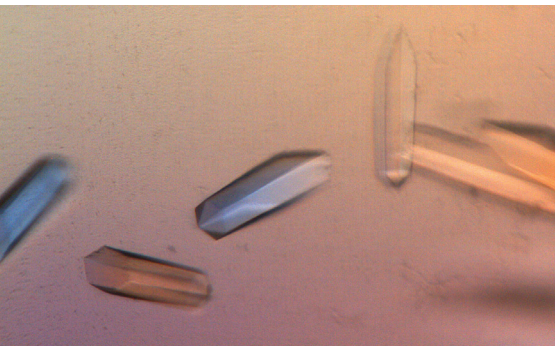


# The Sweet Results of Crystal and Dynamic Structural Inquiry

By Kristen McConnell

Have you ever made rock candy? First, take a lot of sugar and boil it in water. Next, place a string in the mixture as it begins to cool. As the water evaporates, the sugar in the solution concentrates and crystals form on the string.

Through the widely used method of X-ray crystallography, this same basic concept can be utilized on a microscopic level to garner equally sweet results in biological research. During the procedure, a macromolecule such as a protein is placed in solution and then concentrated as the water evaporates, similar to the production of rock candy. To derive the structure, the crystallized macromolecule is bombarded with X-ray beams. The angles and intensities of the diffracted beams are then analyzed to develop a structural model of the macromolecule. X-ray crystallography is just one of the techniques used by faculty in the Department of Biological Sciences to obtain structural information about molecules of interest, such as adenosine deaminases that act on RNA (ADARs), carrier molecules and motor proteins.



Crystallized ADAR

In general, structural biology decodes how macromolecules acquire their structures and how structural alterations affect function. This biological sciences research area is very important, because macromolecules carry out the majority of the functions in cells. Tackling structural biology research are departmental faculty members Mark Macbeth, David Hackney, Gordon Rule and Chien Ho.

The department's resident crystallographer is Assistant Professor Macbeth, whose laboratory focuses on understanding the structure and function of ADARs. This enzyme class fine-tunes nervous system function, and though it is known that an ADAR binds to a few select RNAs, it is not understood how the enzyme and RNA sequences recognize each other. The Macbeth lab's objective is to crystallize and determine the structure of ADAR proteins, RNA and the bound complex. Attempts to crystallize RNA are in the initial stages; however, the lab recently discovered how to generate large amounts of human and yeast ADARs.

X-ray crystallography requires large amounts of the protein and RNA, which are often difficult to obtain. A breakthrough in protein production was conceived by undergraduate researcher Vidhi Dalal, drawing inspiration from Macbeth's postdoctoral work in which an unexpected native molecule, IP6, was discovered within the center of an ADAR molecule. To increase the quantity of purified proteins, Dalal added IP6 to the mixture and was rewarded with a dramatically large yield. Spurred by this success, a significant portion of the Macbeth lab is venturing into the tangential research area of understanding IP6, investigating how this molecule affects ADAR activity and why it localizes to the center of the protein during synthesis.

Macbeth is not the only structural biologist in the department whose work relates to the nervous system; Professor Hackney explores how proteins, particularly the kinesin class of molecular motor proteins, utilize ATP hydrolysis to liberate energy used to drive cellular processes. Kinesin attaches to newly synthesized membrane vesicles and proteins, then moves them along tracks of microtubule inside the cell. This is especially important in nerve cells where kinesin motors move cargo from the cell body down the axon to the synapse. Interfering in this cargo transportation can have potentially serious repercussions. For instance, a disruption in transportation is detected within all Alzheimer's patients.

While studying a motor protein, Hackney observed the protein folding into an inactive form, so his lab worked to locate the interacting protein parts that generated this inactive folded structure. Originally, this structure was assumed to be the result of one of the two tail domains interacting with one head domain, while the second tail domain interacted with the second head domain. In fact, only one tail domain bound to both heads, thus leaving a tail free to bind to other things. "The inhibition of the folded form probably prevents it from wasting ATP when not actively moving cargo," stated Hackney.

While X-ray crystallography enables the study of larger proteins and produces a sharp resolution structure, nuclear magnetic resonance (NMR) allows macromolecules to be analyzed in solution, a more physiologically relevant environment. Differences between the techniques can lead to surprising results during the analysis of protein dynamics.

One of these surprising results was discovered in Professor Rule's lab: an enzyme that transforms from a very large disordered state to an ordered state when bound to its substrate. The enzyme

# Above and Beyond: Outreach

By Maggie Braun, Carrie Doonan and Jeanne Morin-Leisk, *Fourth-year Ph.D. Student, Lee Laboratory*

Dr. Toby Nelson, postdoctoral fellow in Chemistry, and Lena Yu (B.S. '09) with MACAC middle school students.

The Biological Sciences undergraduate and graduate students coordinated and participated in numerous community outreach activities during the past year. While these outreach activities intend to teach and instill a sense of excitement about science to the attendees, they also help to develop many personal and professional skills.

In January, the undergraduates served as judges for the St. Joseph Regional Middle School Science Fair. They also hosted the Mount Ararat Community Activity Center (MACAC) middle school students for a fun day of experiments in May. The MACAC students visited stations led by the undergraduates, where percent solids, foam formation, cost analysis, viscosity and pH tests were performed on a variety of shampoos. The day culminated in oral presentations comparing the shampoos. Visit www.cmu.edu/bio/news/2009/macac.html for more information about this event.

The MACAC students returned in the summer for a weeklong environmental-themed camp. The melanophore activity showed students the basis of color adaptation in fiddler crabs and killifish by observing the color pigments moving in and out of the cell's nucleus. Killing curves demonstrated the harmful effect of second-hand smoke in yeast cells. Students also determined if "green" cleaners worked better than "regular" cleaners, and they investigated beetle infestation. Furthermore, undergraduates taught the MACAC students how to make natural dyes from fruits and vegetables, and then used this knowledge to tie-dye t-shirts. On the final day of the camp, everyone wore the t-shirts to a Recycling Fair, where the MACAC students presented their weeklong project: a new use for an item of trash. Visit www.cmu.edu/bio/news/2009/environmental_camp.html for more information on the environmental camp.

Graduate students have also reached out to the community this past year by tutoring middle and high school students at Winchester-Thurston School and Allderdice High School. Recently, sixth-graders from Winchester-Thurston were also invited by the graduate students to the Mellon Institute in order to solve a fictional crime using molecular biology techniques. "Although they were excited about their glowing DNA, I was a little surprised to find out that they seemed almost as excited about wearing latex gloves," says Kaitlyn Dykstra, a third year graduate student from the Lee lab who helped coordinate the event.

It takes a great deal of planning and preparation by the undergraduate and graduate students in order to provide a successful outreach event. As a result, their teaching, leadership, interpersonal and communication skills are strengthened. The students are looking forward to finding new ways to reach out in the coming year.

To setup an outreach event with your organization or group, contact Maggie Braun at mabraun@andrew.cmu.edu (undergraduates) or Emily Stark at vestark@andrew.cmu.edu (graduates).

class studied – glutathione transferases – protects organisms from carcinogens and other toxic chemicals. "Normally, people think of proteins as being well formed and having a fairly unique stable confirmation form. However, the NMR analysis of glutathione transferases shows that a large segment is disordered. When it binds to its substrate, it actually folds up and becomes ordered," said Rule. Without an NMR analysis, this change in structure may have gone unnoticed.

A disadvantage to the current NMR technique is the amount of time required for protein analysis; a key component of this slowdown is the assignment of resonance lines to each atom in a protein. The Rule lab is designing and improving software that utilizes Monte Carlo methods to automate these assignments.

Shortening the time of NMR analysis would also be beneficial to Professor Ho, NMR Center Director, who studies hemoglobin structure in order to better understand how oxygen is transported from the lungs to tissue. The Ho lab analyzes this protein using high field NMR with many surprising results.

As described in a recent report by the Ho lab, the soluble structures of hemoglobin in both ligated and unligated forms are dynamic ensembles of various structures, which are not the same as those in crystal form. NMR analysis also revealed new dynamic information about the side chains and backbone of the hemoglobin molecule that could not be directly inferred from crystallography. Ho's new findings challenge the classical two-structure allosteric model for the cooperative oxygenation of hemoglobin. The new structural and dynamic information about hemoglobin is expected to provide insights into the design of a new generation of hemoglobin-based oxygen carriers – blood substitutes.

NMR and X-ray crystallography both bring unique benefits that combine to enhance structural knowledge of biological macromolecules such as enzymes, structural proteins, carrier molecules, nucleic acids and carbohydrates. The department's structural biologists utilize both of these techniques to further their work, extracting very sweet results.

# Around the World: Fulbright Scholars

By Kristen McConnell

The rich reds, yellows and oranges that envelop the autumnal landscape are a welcome and expected occurrence on Carnegie Mellon University's campus. Surprisingly, when Rashi Venkataraman, a 2008 Biological Sciences alumna, described this transformation to her Indonesian students, they found it unfathomable.

Sharing ideas and experiences across cultures, even something as seemingly insignificant as leaves changing colors, can benefit everyone. This enrichment through the free flow of ideas is a core focus of the Fulbright U.S. Student Program, sponsored by the U.S. Department of State, which enables students to teach, study and conduct research in 155 countries.

Two recent Biological Sciences alumni were awarded these highly prestigious and competitive grants. Venkataraman received an English Teaching Assistant position, while a research grant was given to 2009 graduate Gregory Newby.

From May 2008 to July 2009, Venkataraman lived in the small town of Salatiga on the Indonesian island of Java, where she taught English conversation skills at a public high school, worked with the school's debate team, and participated in English clubs for teachers. She also attended informal monthly group meetings with other female teachers. Facilitating discussions at these meetings on topics such as how the women planned their families allowed her to utilize her biology and public policy education, expand her interests in women's health issues, and develop a better understanding of Indonesian culture. "You can always list the differences [between cultures], but when you see the similarities, a lot of bridges can be built from that," said Venkataraman.

Rashi Venkataraman with her students in Salatiga.

Gregory Newby at Lake Luzern.

Besides interacting at the women's meetings, she represented the State Department at events. She judged an American embassy-hosted debate between two Indonesian universities and served on numerous question-and-answer panels about American education and culture.

Venkataraman continues to combine her science and policy interests as she works towards an M.S. in Healthcare Policy and Management at Carnegie Mellon's Heinz College. "My Fulbright experience made me realize that there are a lot of opportunities nationally and internationally that allow you to truly improve the lives of others," said Venkataraman.

Focusing strictly on research, Gregory Newby is currently a Fulbright scholar in the laboratory of Andreas Plückthun at the Biochemistry Institute of the University of Zürich. "My research experiences at Carnegie Mellon, particularly the time I spent in Associate Professor Peter Berget's lab, really prepared me for my research here in Switzerland. The courses also provided me with enough biological background that I can understand and work through the problems I face in the lab," stated Newby.

While in Switzerland, Newby is building biosensors out of Designed Ankyrin Repeat Proteins (DARPins), small and stable binding molecules that are expressed in most cellular compartments. DARPins can bind to small organic dyes that fluoresce only when constrained; these protein-dye pairs are known as fluoromodules. A fluoromodule that is expressed in the cytoplasm may become an alternative for the common marker GFP, because DARPins are fast-folding, need no time to mature, and only fluoresce when cell-permeable dye is supplied to the cell. Newby plans to construct fluoromodules and then characterize their fluorescent properties and structure. The Plückthun laboratory and Newby are collaborating with another group that uses fluorogenic dyes to construct biosensors: Carnegie Mellon's own Molecular Biosensor and Imaging Center, directed by Biological Sciences Professor Alan Waggoner. After completing the flouoromodule project and his Fulbright experience in June 2010, Newby will begin MIT's graduate program in biology.

"The Fulbright program provided an opportunity to learn about different things, ideas and locations that I wouldn't have necessarily sought out otherwise," stated Venkataraman. The boundaries of knowledge, collaboration, wisdom, empathy and perception expand, when students like Venkataraman and Newby are awarded Fulbright grants and share even the simplest ideas, such as leaves changing colors.

Continued from Page 3

of its interdisciplinary focus and reputation for computational excellence…I can say that it has exceeded all of my expectations." Jessica is currently studying at Oxford University in the United Kingdom. Similarly, Donghun Lee, M.S. 2009, now a computer science doctoral student at Princeton, describes his experience in the M.S. program, "The flexible curriculum encourages innovation: I obtained a solid foundation in machine learning techniques and participated in interdisciplinary research projects. Now my research continues to make programs to spot meaningful trends in high-throughput data."

Alumni praise the graduate programs for their scientific expertise, confidence and eventual successes. "Besides giving a solid grounding in scientific research, the Biological Sciences Department also provided a nurturing environment to develop various other skills like teaching, public speaking, scientific writing for a non-technical audience, among others. A little taste of all these things is important to prepare a graduate level class for the various careers the sciences can offer," remarked Nisha.

Both the M.S. and the Ph.D. programs train students to be critical and independent thinkers: able to observe an event, draw upon a relevant knowledge base to interpret that event, and to offer conclusions, even ones that may be contrary to dogma or the current vogue. Obviously, these critical thinking skills can be portaged to a variety of careers. Affirming our success in guiding and educating, our graduates boldly take their Carnegie Mellon training and follow their own preferences for satisfying and meaningful life's work.

# Alumni Updates

**Yuliya Anikanova (B.S. '04)** graduated from Jefferson Medical College in 2009 and is now a pediatrician.

**Gargi Bajpayee (B.S. '08)** is in her first-year of medical school at Marshall University's Joan C. Edwards School of Medicine.

**Pamela Bush (Ph.D. '02)** received an MBA from Carnegie Mellon in May 2009 and accepted a position at Eli Lilly.

**Jennifer Crew (Ph.D. '95)** is a laboratory research scientist for the Illinois Department of Public Health developing an assay to screen for multi-drug resistant *M. tuberculosis* by DNA sequencing.

**Mindy DeRouen (B.S. '02)** completed her doctorate in cancer biology from Stanford University in Dec. 2009. Her research clarified aspects of the function of laminin and integrin proteins in hair follicle development and the growth of basal cell carcinoma.

**Josh Earl (M.S. '09)** has been named director of bioinformatics at the Center for Genomic Sciences, a part of Allegheny General Hospital.

**Amanda Gonzalez (B.S. '07)** is a researcher in the Products Research Division at Procter & Gamble. She was also just accepted to an MBA program.

**Kai Huang (Ph.D. '04)** works in Hong Kong for Balyasny Asset Management as a portfolio manager managing a book on Greater China equities.

**Prateek Kumar (M.S. '06)** is a senior bioinformatics analyst at the National Cancer Institute in Bethesda, Md., where he aids cancer research by building array data processing.

**Robert Last (Ph.D. '86)** is chair of the board of directors for an NSF Cyberinfrastructure project, which seeks to produce tools to address challenges in the plant sciences.

**Donghun Lee (M.S. '09)** is a computer science doctoral student at Princeton.

**Lukas Manomaitis (B.S. '95)** is an independent consultant and technical director for Aquaculture for Southeast Asia, and recently married Nguyen Thi Ninh Ket in Ha Long Bay, Vietnam.

**Gregory Newby (B.S. '09)** is a Fulbright scholar in the lab of Andreas Plückthun at the University of Zürich.

**Wendy Niedelman (B.S. '07)** is working towards a doctorate at MIT in Jeroen Saeij's laboratory, studying host pathogen interactions with *Toxoplasma gondii*.

**Parul Nisha (Ph.D. '07)** works at the National Institute of Diabetes and Digestive and Kidney Diseases, where she is investigating the role of RNA silencing machinery on the function of chromatin insulators.

**Lisa Pascoli (B.S. '07)** is pursuing a doctorate in Physical Therapy at MGH Institute of Health Professions in Boston, Mass.

**Robia Pautler (Ph.D '99)** received tenure and a promotion to associate professor at Baylor College of Medicine. She also welcomed the birth of her daughter, Madeline Helen.

**Manoj Puthenveedu (Ph.D. '04)** has joined the Carnegie Mellon Department of Biological Sciences as an assistant professor.

**Ayush Raman (M.S. '08)** works as a statistician at Western Psychiatric Institute and Clinic, UPMC Presbyterian Hospital, in the area of genome-wide association studies to understand the causes of autism and Alzheimer's disease.

**Sheree Rybak (Ph.D '97)** is an attorney at Klarquist Sparkman, LLC, where she works in the area of patent and trademark law.

**Jeff Schloss (Ph.D. '79)** is program director, Technology Development, at the National Human Genome Research Institute, where he directs the program to develop genome sequencing technology. He also co-chairs the Nanomedicine Roadmap Initiative and was founding co-chair of the Trans-NIH NANO Task Force.

**Nan Song (Ph.D. '06)** is employed as a research scientist at Precision Therapeutics, Inc., in Pittsburgh, Pa., where she utilizes computational biology for personalized medicine.

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# Alumni Updates

**Jennifer Graham Spanier (Ph.D. '92)** is a freelance non-fiction book and website indexer at Spanier Indexing, specializing in health and life sciences.

**Mangala Srinivas (Ph.D. '07)** is a postdoctoral fellow at the Nijmegen Center for Molecular Life Sciences in the Department of Tumor Immunology.

**Shoba Subramanian (Ph.D. '05)** works as a senior postdoctoral fellow in the Mitchell lab at Carnegie Mellon, where she investigates the critical molecular players in the signal transduction pathways activated in yeast cells in response to external pH changes.

**Jerry Vockley (B.S.'78)** is a professor of pediatrics and human genetics at the University of Pittsburgh as well as chief of medical genetics at Children's Hospital of Pittsburgh.

# Reconnect
## with fellow alumni.

Join us on Facebook. Become a mentor. Help support graduate student travel awards. Help support undergraduate research efforts. Speak at our seminar series. Volunteer at the BioSAC booth during Carnival.

Class of 2009

www.cmu.edu/bio/alumni

**The Promoter** Winter 2010

**Designer and Editor**
Kristen McConnell

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PHOTO CREDITS
Front Cover: Bradley Yates. Page 2: Ken Andreyo, Alys Cheatle and the Hinman Laboratory. Page 3: Courtesy of Donghun Lee, Kai Huang, Parul Nisha and the Department of Biological Sciences. Page 4: Courtesy of the Macbeth Laboratory Page 5: Courtesy of the Department of Biological Sciences and MACAC. Page 6: Courtesy of Gregory Newby and Rashi Venkataraman. Page 8: Courtesy of Blink Ink Photography.