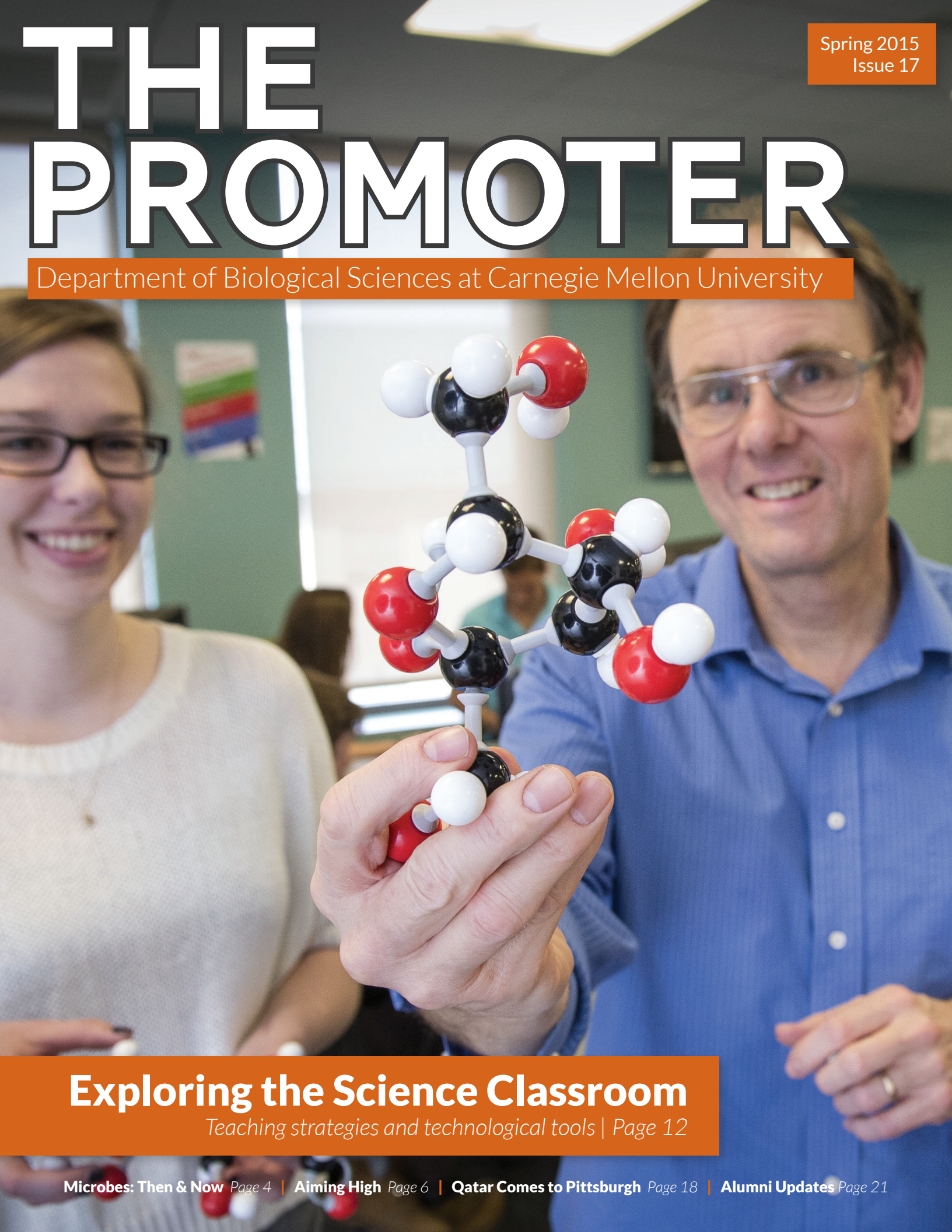
THE PROMOTER

Spring 2015
Issue 17

Department of Biological Sciences at Carnegie Mellon University



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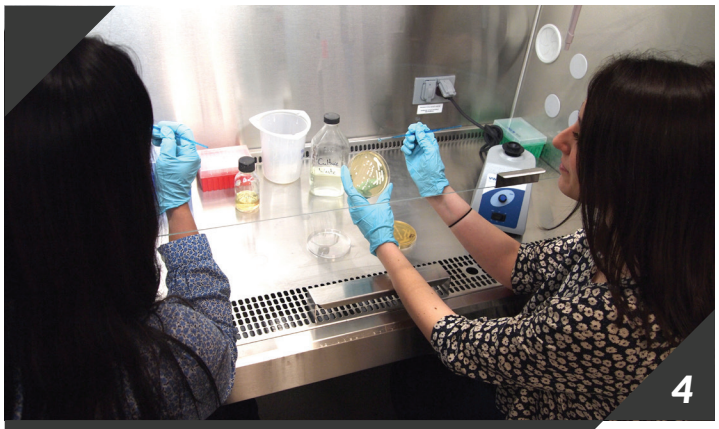
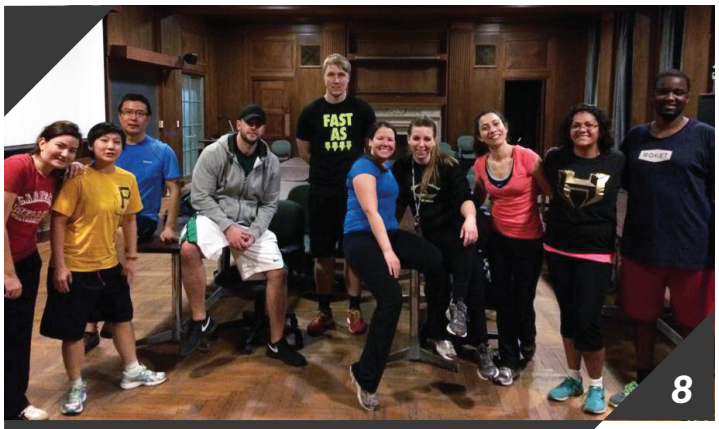




On the cover: *Gordon Rule, Ph.D. and undergraduate student Ali Celentano share molecular models in biochemistry. Photo credit: Tim Kaulen*

LETTER FROM THE DEPARTMENT HEAD

Aaron P. Mitchell, Ph.D.
Acting Department Head
Professor, Biological Sciences

This is a very exciting time to be at Carnegie Mellon! If you walk through our campus, particularly the halls of the Mellon Institute, you will see, hear, and feel the energy and excitement radiating from our new college-wide and campus-wide initiatives -- collaborative research centers, teaching innovations, a comprehensive overhaul of the undergraduate core curriculum in the Mellon College of Science (MCS), a new major in neuroscience in collaboration with the Dietrich College of Humanities and Social Sciences, a growing population of enthusiastic graduate students in our Ph.D. in Biological Sciences and M.S. in Computational Biology graduate programs, a student-led gymnasium offering fitness classes in Mellon Institute, and finally, the ongoing renovation of the third floor loading dock area of the Mellon Institute, which will provide new space for collaboration and interaction.

Since taking charge in summer 2013 as CMU's ninth president, Subra Suresh and his leadership team, including Nathan Urban, interim provost and professor of biological sciences, have established a panel of Strategic Initiatives that seek to develop CMU's areas of strength. One prominent example is BrainHUB, which connects CMU neuroscience researchers, including six faculty members from Biological Sciences, with an array of global partners in the area of brain research. President Suresh and leaders on campus have also established the ProSEED grant program, which seeks to develop innovative and interdisciplinary research and education projects. Several of Biological Sciences's faculty and students have been awarded these grants, some of which are featured in this issue of the newsletter. I am very pleased to see the alignment between our department's objectives and the university's broad vision for the future.

Research in the field of microbiology is a new and emerging area within the department. We already have over six faculty members asking scientific questions in this broad discipline. Luisa Hiller and I both study how bacterial and fungal pathogens establish self-sufficient and impenetrable colonies known as biofilms within host cells. Accompanying us on this crusade to better understand pathogenesis is Fred Lanni, who builds innovative imaging tools to be able to better visualize pathogens deep inside the biofilms, and Dannie Durand, who helps analyze the vast amounts of DNA and RNA sequencing data using computational and phylogenetic methodologies. In addition, Brooke McCartney is investigating the relationship between the gut microbiome and brain behavior in fruit flies with exciting early results. Adam Linstedt has discovered manganese as a potential therapeutic against Shigella infections. A lot of these projects are fueled not only by joint grant funding, but also by several ad hoc water cooler ideas and discussions.

Several far-reaching changes in MCS and Biological Sciences are in the education arena. Faculty and staff involved in our undergraduate programs have already geared up to smoothly implement updates to the MCS core curriculum, which allow for stronger foundations and deeper understanding of the interconnectivity between the four areas within MCS, namely biology, chemistry, mathematics, and physics. Maggie Braun, assistant department head for undergraduate affairs, has been appointed Director of MCS Core Education, and will assume her new role later this summer. Our graduate programs have seen significant growth in quantity and quality in recent years, with a total of 31 incoming students in fall 2014. Our new advising format for Ph.D. students leads the nationwide awareness toward preparing Ph.D. graduates as professionals to compete for a variety of jobs, as reflected in mandates by funding agencies such as the NIH. This effort is led by Shoba Subramanian, the Assistant Department Head for Graduate Affairs, who works with the core faculty to advise Ph.D. and M.S. students for a variety of biomedical careers. Finally, the M.S. in Computational Biology program (a joint program with the Computational Biology Department in the School of Computer Science) is being revamped with creation of a new curriculum to be offered to students matriculating in 2015. This new curriculum allows for a well-rounded foundation in core areas of computational biology and bioinformatics with several depth courses in specialized fields such as bioimaging and machine learning -- areas where CMU is a global leader. As a lead into this new curriculum, a new course on professional issues, co-taught by the assistant directors of the program, has been offered for the past two semesters. This successful course meets weekly to prepare students for the job market by actively helping them polish their soft skills.

I invite you, alumni and friends, to connect with us in any way that is convenient for you.

Sincerely,

Aaron P. Mitchell, Ph.D.
Acting Department Head

Microbes: Then & Now

A "candid" look at microbiology in the department

WRITTEN BY ANAGHA KADAM

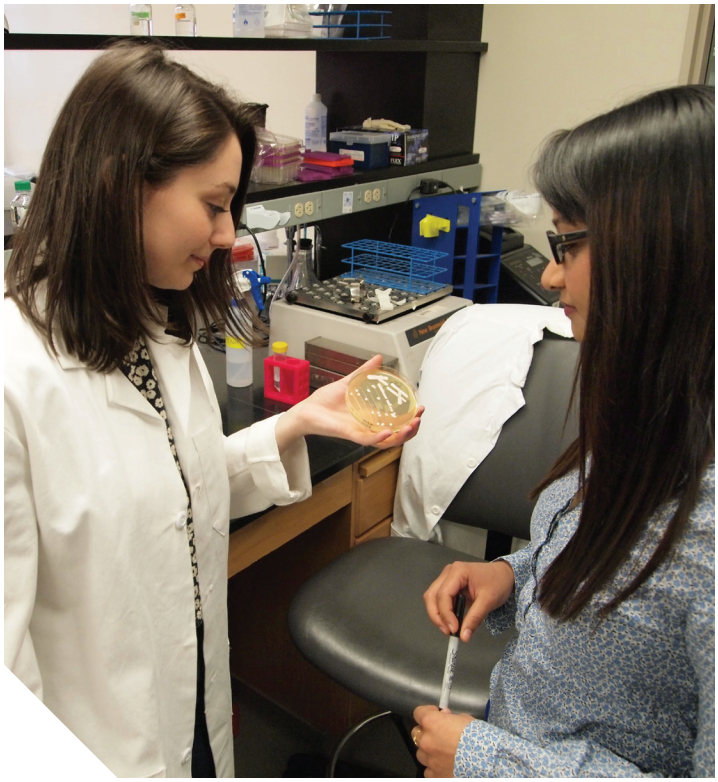
A 17th century soul, Anton von Leeuwenhoek, is regarded as the father of microbiology. Leeuwenhoek, who was a draper by profession and a lens-maker for recreation, was the first person to see microbes. To him, it would have been like watching unicorns fly. This opened a new door to a world that exists beyond what meets the human eye. Since then, centuries have gone by as we've witnessed a beautiful evolution of the big questions microbiologists are curious about: Where do microbes come from? Is there spontaneous generation? Are microbes good or bad? How are diseases like malaria or the plague transmitted? By the turn of the 20th century, a few swan-neck flasks, mason jars, meat broth, maggots, and the brilliant minds of exceptional scientists had answered most of these questions.

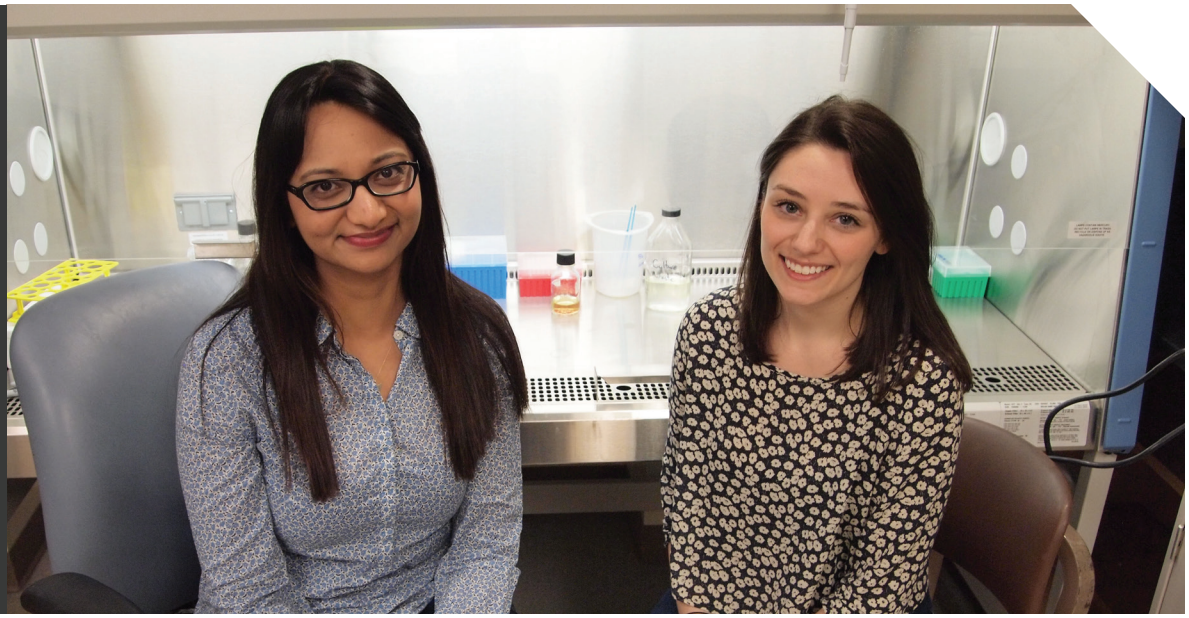
The spotlight quickly shifted onto the intricacies of the microbe's life – understanding their genes, proteins and molecules. What do microbes do for a living? What micro-machineries help them respond to their environment? How are their genes regulated? The elegant simplicity of microbes attracted the scientific glitterati in all fields; they soon became micro-factories for engineered products, models for unraveling the mysteries of gene expression and tools for gene cloning. A few decades later, the dawn of the genomics era was upon us. Large-scale genome projects began shooting sequencing data like confetti, and microbiologists were free to pick and choose their favorite bug, favorite genes, and favorite pathway as their specialty.

Thousands of genomes later, Katie Lagree and I, two microbiology-focused graduate students in Biological Sciences, have questions of our own. How is it that some microorganisms colonize humans without any obvious symptoms, but turn lethal under certain conditions? Is there a "Pathogen ON" signal? How do they "know"? Do microbes talk to each other? Is there an app for that? If you have been asking these questions and are looking for some answers, walk into the "hall of microbiology" on the second floor of the Mellon Institute, home to the Mitchell and Hiller labs.

We work on *Candida albicans* and *Streptococcus pneumoniae* (pneumococcus), respectively. Both Candida and pneumococcus are important opportunistic pathogens in humans. Candida, a fungal pathogen, can cause mucosal or invasive candidiasis and its ability to grow on implanted medical devices is a grave concern in hospital settings. Pneumococcus is one of the most common causes of severe community-acquired pneumonia, ear infections, meningitis, sinus infections and bacteremia. If you had a painful ear as a kid and it required an ear tube to be put in, you could probably blame it on pneumococcus. Today, the emergence of drug-resistance and vaccine-escape strains has often led to treatment failures and/or recurrent infection.

Both Candida and pneumococcus form complex communities in human body sites or on medical devices, called biofilms (think a micro-scale picnic mat), the microbes thrive, strategize, and evolve within them. Biofilms are a resilient conglomeration of microorganisms embedded within a self-produced slime consisting of proteins, polysaccharides, dead cells, DNA from dead cells, and other secreted goodies. Biofilms are hotspots for communication and DNA exchanges between microbial cells leading to rapid evolution of new strains. In addition, the structural robustness and the heterogeneity often make biofilms resistant to killing by antibiotics. In contrast, the planktonic life form, where microbial single cells freely swim in liquid medium, is relatively less dynamic and unrepresentative of an established colonization.





Anagha Kadam and Katie Lagree in front of a biosafety cabinet in the Hiller lab

The first lesson one learns in a microbiology lab is that the life inside a test tube is not equal to the life inside a human body. Fortunate to be working in the golden age of molecular tools and animal models, Katie and I try to make our research as relevant to the human host as possible. Thus, we do not study our bugs floating solo in a flask full of their favorite food. We study them in biofilms. We focus on pathogenic molecules and components that are relevant in vivo to identify the key players in virulence. In the old days, dealing with a pathogen was synonymous with shooting cannonballs of antibiotics at it. The winds of change are now calling for an "anti-virulence" approach, wherein therapeutic targets will be molecules that play key roles in virulence. For example, targets may include the transcriptional factor that doubles as a master switch to toggle between commensal and pathogenic lifestyles, or that stealthy communication signal between microbial cells that allows them to sense the right cell number to mount an attack. This may be especially relevant to opportunistic pathogens that can be asymptomatic by-standers in the natural microflora.

In the Hiller Lab, we study pneumococcus, which is a rapidly evolving bacterium very fond of changing its DNA. Thus, the pneumococcus genome is really a "pangenome" with some genes being strain-specific that may be critical in virulence. I study the strain-unique genes in a group of pathogenic strains that are responsible for pandemicity and multi-drug resistance in order to understand their ecological and epidemiological success. I investigate this by studying genes "ON" during infection, testing their role in bacterial warfare and tracing their evolutionary history with invaluable guidance from the Durand lab, the home for bio-computational wizards.

The Mitchell Lab has implemented a new and highly sensitive technology to determine which genes a pathogen expresses during animal infection. Prior to this, fishing for pathogen RNA (<1%) in a sea of host RNA (>99%) used to be a daunting task. Katie's big question is to understand the complex genetics of Candida biofilm formation to identify virulence factors that could be targeted for therapeutics. Through a combination of genetic tools and cutting edge transcription profiling, Katie aims to decode the function and downstream effectors of her favorite genes to elucidate a gene regulatory network involved in virulence. And since we love to glow at Biological Sciences, Katie also works on creating a spatial map of differentially expressed regulators that would fluoresce, taking our understanding of the physical and molecular heterogeneity of biofilms to the next level.

The core Micro group at CMU collaborates with multiple groups inside and outside CMU. Within CMU, Fred Lanni, with the treasure of his chemistry knowledge, is always thinking of new, non-living surfaces for microbial growth, and re-inventing the way we visualize biofilms and invasion. Sometimes he starts with sophisticated polymers with tongue-twisting names but other times he uses the glue from his sliced ham lunch containers! Further down the hall, Adam Linstedt and his team work on understanding the molecular mechanism of Shiga toxin trafficking inside host cells. Brooke McCartney's lab, having aced multiple areas in fly development, is venturing into decoding the microbiome of a fly and is further investigating the role of the microbiome in fly behavior. Thus, more labs in the broader scientific community of CMU Biological Sciences are working at the intersection of microbiology and other areas of biology.

Under the guidance of scientists like Aaron Mitchell, Luisa Hiller, Fred Lanni, and Dannie Durand, and the continued support from the Department of Biological Sciences, the core Micro group hopes to grow and contribute to the knowledge of pathogenesis mechanisms. I bet if Leeuwenhoek's ghost ever wanders in our hallway, he would certainly find our "pneu" stories very "candid".

Aiming High

Talking with two Biological Sciences alumni about their paths from Carnegie Mellon University to the United States Air Force

INTERVIEWED AND WRITTEN BY SHOBA SUBRAMANIAN

Rajesh Naik
(Ph.D. '98)

Ph.D. Thesis Advisor: Elizabeth W. Jones, Ph.D.
Thesis Title: *The Modulation of Expression and Post-translational Processing of the Yeast Vacuolar Protease B*

Rajesh Naik works as a research leader for the Biological Materials Team at the Air Force Research Laboratory (AFRL). His team studies biological materials for sensing electronics and in catalytic applications by characterizing fundamental structure-property relationships of biomaterials and interfacing biomaterials with nanomaterials. Ultimately, his projects are geared towards developing technology solutions for the Air Force.

Morley Stone
(Ph.D. '97)

Ph.D. Thesis Advisor: William E. Brown, Ph.D.
Thesis Title: *Polyurethane hydrolysis: The creation of a catalytic antibody specific for the carbamate bond*

Morley Stone is the Chief Technology Officer of AFRL, where he serves as the primary technical advisor to the lab's commander, Major General Tom Masiello. His duties range from representing the thousands of scientists and engineers from across the enterprise in all Air Force headquarters engagements to ongoing efforts in recruiting the highest quality scientists and engineers as well as retaining and refreshing the enormous talent that the Air Force already has.

Naik and Stone are colleagues at the Air Force Research Laboratory (AFRL), but they have a connection that goes back to 1992, when both were first-year graduate students in our department's Ph.D. program. Naik was finishing a master's degree in microbiology from Duquesne University, during which time he visited CMU Biological Sciences and had fallen in love with the faculty and the curriculum. This enforced his decision to join our program. "I became even more interested in the program after my interview at CMU, where I had the chance to meet with John Woolford, Beth Jones, and Eric Grotzinger, among others, as well as the senior graduate students. I had such a positive and energizing meeting with the faculty that it made me want to join CMU," says Naik about his decision to join the Ph.D. program.

Stone, on the other hand, was already working at the Air Force, directly out of his undergraduate degree. He was selected into the Palace Knight program, which allows Air Force employees to go to graduate school. As diverse as Naik's and Stone's backgrounds were at that time, they had very similar enriching experiences during their graduate student days at CMU.

Both Naik and Stone agree that the rigor of the first-year coursework at CMU played a huge part in shoring up their critical thinking and analytical skills. They have fond yet intense memories of their days during their first two semesters. Both are particularly thankful to the "intellectual giants", such as John Woolford, Beth Jones, and Will McClure, who taught advanced courses that solidified their training as scientists. Naik says, "I still remember when Beth would makes us draw out genetic crosses on the blackboard during the Advanced Genetics class. It taught us to think on our feet. I would be terrified that I would mess up, but it taught me to always be prepared and confident." Then he says while describing his training in the Jones lab , where he studied protein processing and trafficking in yeast, "I was taught to be rigorous when it came to research. During lab meetings Beth would be very critical about research results presented and making sure the correct controls were performed, and whether we were asking the right questions. At that time, I would wonder why she was hard on us but I now appreciate that very much."

Stone chose Bill Brown as his thesis advisor. He says he really enjoyed the interdisciplinary training he received at CMU. According to Stone, "In addition to the scientific training, I received training from my Ph.D. thesis advisor and mentor, Bill Brown, on how to treat and interact with people. Outside of my parents, Bill was probably the single most important person from a 'lead by example' perspective." Stone also benefited from the grant writing skills he gathered at CMU. "My training at CMU was absolutely critical to me securing my first research grant from the Air Force Office of Scientific Research (AFOSR)."

After his graduation, Naik took up a post-doctoral position with Eileen White in the Center of Advanced Biotechnology and Medicine at Rutgers University under an HHMI fellowship, while Stone returned to the Air Force. A few months into his postdoc, Naik decided it was the right time to start exploring long-term career choices. In spring of 1999, Naik sent an email to his former classmate, Stone, to catch up on where they were in their jobs and how life after graduation was treating them. Upon receiving this email, Stone invited Naik to visit the AFRL. Naik wasn't even aware of what happens at the AFRL, but decided to go visit his old pal anyway. And that one visit completely changed Naik's life and opened the door to a whole new career. By fall of 1999 Naik was working as a research scientist with Stone in the Biotechnology Group at the Materials Directorate in AFRL. In 2004 he was hired into the civil service as a research scientist, and he eventually became the biotechnology research group leader in 2005.

Naik and Stone enjoy their jobs immensely as they not only allow them to contribute to the intellectual community in general, but they also give them deep pride and joy in serving their country.

When asked what words of wisdom they had to offer current students, Stone said that students should be thankful for being a scientist during such an amazing era of technology and science. "The change we are experiencing in the life and human sciences is truly transformative. As such, it is extremely important to embrace continuous learning and look for those opportunities to stretch yourself, both personally and professionally. It is during those periods of being stretched that you also grow and acquire skills that will serve you well long your career, no matter what path you take. In addition, the scientific world is changing so fast; don't get too preoccupied with planning every step. If you apply the training and creativity acquired during your CMU years, enormous opportunities will be afforded to you. Just be willing to take the leap."

Naik said that there are plenty of opportunities for graduate students, but that finding the right one is critical. There are opportunities in non-traditional settings such as national labs, which even host short summer internships for graduate students, so that students can "try out" programs before making a long-term commitment. Hence, Naik thinks doing your homework is critical. "Do not be afraid to seek advice and reach out to folks. Don't just send an email out to prospective employers or PIs. Try and learn about what they do, figure out where they present their work. Seek them out at meetings and try to get a few minutes of their time to talk with them. Attend seminars, even outside your discipline. The research enterprise is becoming highly multi-disciplinary, and in order to be successful you need to acquire a broader skill set to make yourself more marketable. I never knew about the intersection of bio with nanoscience back during my Ph.D. days, and now I combine biology with nanoscience and materials science."

Mellon Gets FIT

Introducing Mellon FIT, a new initiative by Biological Sciences and Chemistry students and staff to make Mellon Institute a healthier place to work and learn

WRITTEN BY NATE FREZZELL

About a year ago Olivia Molinar came to me full of excitement. As a Ph.D. candidate in the Department of Biological Sciences, she had a variety of requests for her time and focus, so she was constantly working on the best way to better herself.

She had just recently incorporated fitness into her weekly routine, and had completed more than a month of training with me as her personal trainer. As a result, she noticed an increase in productivity and focus in the lab. Her P.I. even noticed changes in her presentations and lab work. So, on that day in February, Olivia planted the seeds of what would eventually grow into Mellon FIT. Her hope was to gather support amongst other students to someday have fitness classes, and possibly a gym, in the Mellon Institute.

Olivia eventually reached out to other students in both Chemistry and Biology. She piqued the interest of several people and created the Mellon FIT Committee. Mellon FIT is currently comprised of nine individuals from both the Chemistry and Biology Departments that meet monthly with the goal of bringing health and fitness awareness to everyone in the Mellon Institute. Thanks largely to ProSEED funding and the Student Affairs office, the group has been able to provide free classes to anyone interested. The group even completed its larger goal of creating a gym in the Mellon Institute.

The major goal of any group is sustainability. The Mellon FIT Committee is currently accepting donations of gym equipment as well as taking suggestions for how to make the program better. In a most recent effort, the group completed a crowd-funding campaign in hopes of continuing to provide free classes in Mellon Institute.

Mellon FIT is always looking for interested individuals to add their ideas to help this initiative grow and survive. If you have any questions or inquiries about Mellon FIT, you can email mellonfit@gmail.com.

Nate Frezzell is an administrative coordinator for the Department of Biological Sciences and teaches fitness classes for Mellon FIT.

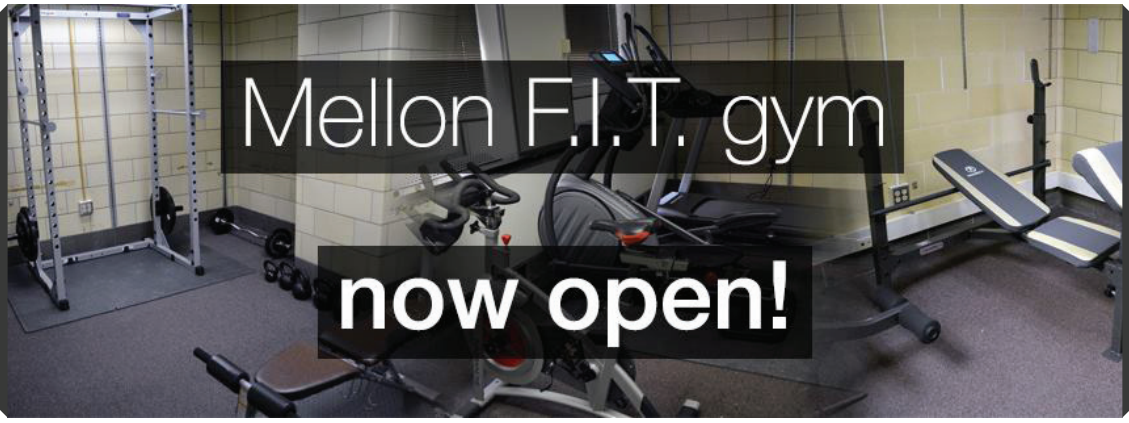
History of Awards and Contributions Received to Make Mellon FIT Possible

Spring 2014 – Olivia Molinar (Ph.D. ’17), Jon Willcox, Nathanuel Frezzell, and Pawel Krys awarded ProSEED Crosswalk Seed Grant for “Mellon Fitness Intensity Training (F.I.T.)”

Fall 2014 - Olivia Molinar, Jon Willcox, and Pawell Krys awarded ProSEED Crosswalk Seed Grant for “You Are What You Eat: Providing Nutritional Guidance in High Stress Oriented Programs from Mellon F.I.T.”

Spring 2015 - Madhumitha Ramesh (Ph.D. ’16) and Olivia Molinar raised $2,694 for Mellon FIT health and fitness classes as part of CMU’s crowdfunding campaign

Graduate students from the Mellon College of Science and Mellon FIT instructors pose after a workout session



Mellon FIT yoga class led by Biological Sciences graduate student Vinitha Ganesan (Ph.D. '18)

DEPARTMENTAL HIGHLIGHTS

Alison Barth (Faculty) received a 2014 Talent Travel Award from Humboldt University, and an NIH grant to explore "Neocortical representations of cold."

Shanna Bowman (Bowersox) (Ph.D. '16) was selected as a Graduate Teaching Fellow by the Eberly Center for Teaching Excellence where her responsibilities, among other things, include facilitating early course feedback focus groups and microteaching workshops; presenting student feedback to instructors; and holding consultations with graduate students.

DJ Brasier (Faculty) was selected as a Wimmer Faculty Fellow at CMU's Eberly Center for Teaching Excellence.

Bill Brown (former Department Head) "Imaging Life: Biological Systems from Atoms to Tissues" was published posthumously.

Marcel Bruchez (Faculty) was awarded a Kaufman Foundation grant for understanding neural circuitry in the mammalian neocortex as well as an NIH grant for exploring brain-scale measurements of cell-specific synaptic contacts, both in collaboration with **Alison Barth (Faculty)**. In addition he received two NIH grants: a 5-year grant on Fluorogen Activating Peptide-Based FRET to Quantify FceRI Activation Mechanisms (in collaboration with Diane Lidke at the University of New Mexico); and another one for ROS driven mitochondrial-telomere dysfunction during environmental stress (led by Ben Van Houten and Patricia Opresko at the University of Pittsburgh).

Chuck Ettensohn (Faculty) was appointed associate editor at BMC Genomics and received National Science Foundation (NSF) funding for "Analysis of a Gene Regulatory Network in Early Animal Development."

Veronica Hinman (Faculty) joined the Editorial Board of EvoDevo, as well as the Scientific Advisory Board of SpBase/EchinoBase.

Chien Ho (Faculty) received a Highmark Disruptive Health Technology Institute (DHTI) grant for "A Novel Approach to Improve the Delivery and Reduce the Toxic Side Effects of Anticancer Nanodrugs by Intralipid."

Anagha Kadam (Ph.D. '18) won the Best Poster Award at the 20th Annual International Meeting on Microbial Genomics, in Lake Arrowhead, California, and received GSA/Provost Conference Funding in September 2014.

Karen Kormuth (Ph.D. '16) received a 2014 Love of Learning Award from The Honor Society of Phi Kappa Phi.

Sandra Kuhlman (Faculty) was awarded a 5-year NIH grant for studying "Inhibitory regulation of visual processing and plasticity in visual cortex." In addition, she received funding from the Flight For Sight Foundation and the Knights Templar Eye Foundation.

Tina Lee (Faculty) received a 5-year NIH grant to investigate the mechanism and role of membrane fusion by the atlastin GTPase.

Olivia Molinar (Ph.D. '17) was the Research Initiative for Scientific Enhancement (R.I.S.E.) Invited Seminar Speaker at the University of Texas at El Paso. In addition she received the American Society for Cell Biology's (ASCB) Minorities MAC Travel award and the Society for Advancement of Chicanos and Native Americans in Science (SACNAS) Travel Scholarship.

Bob Murphy (Faculty) received a 5-year grant award from NIH for work on building generative models of cell organization in conjunction with Gustavo Rohde and **Tina Lee (Faculty)**. In 2014, Bob became an Associate Editor of Bioinformatics, responsible for manuscripts in the area of bioimage informatics. In 2014 he also completed 23 years of continuous service as a member and chair of NIH study selections.

Manoj Puthenveedu (Faculty) joined the Editorial Board of Traffic, a respected journal in cell biology that disseminates influential publications on membrane trafficking research.

Madhumitha Ramesh (Ph.D. '16) was a winner and finalist in both the 2014 and 2015 3-minute thesis iPad heats. She also received the RNA society's travel award to Quebec City, and was the only non-MBA team member at the McKinsey case competition at the Tepper School of Business, where the team won first place in the competition.

Dan Shiwarski (Ph.D. '17) was a selected speaker at the Local Traffic Meeting in 2014. In addition, Dan won the First Place Poster and Talk Award at Great Lakes GPCR Conference in Montreal, was invited to speak about "Regulated Surface Delivery of the Delta Opioid Receptor" at Gordon Research Seminar, and will serve as the elected Chair at the Gordon Research Seminar in Girona, Spain in 2016.

Shoba Subramanian (Faculty) was selected as a Wimmer Faculty Fellow from the Eberly Center for Teaching Excellence.

Nathan Urban (Faculty) received a $930,000 grant from the National Science Foundation (in collaboration with Rob Kass) to apply biological and statistical neuroscience approaches in order to create a better overall understanding of how neurons encode information.

Amanda Willard (Ph.D. '18) was awarded the 2014 Dolmetsch Carnegie Graduate Fellowship from the CNBC, and won a best poster award at the CNBC annual retreat.

John Woolford (Faculty) co-directs The Center for Nucleic Acids Science and Technology (CNAST) with Bruce Armitage, which received a $3.1 million gift from the David Scaife Family Charitable Foundation. In addition, his long-standing NIH grant was renewed for years 32-35.

UNIVERSITY & DEPARTMENTAL AWARDS

GRADUATE STUDENT SERVICE AWARD

This award is given to a Biological Sciences graduate student for their service within and outside the department.

The following student was awarded the Graduate Student Service Award for 2014–2015:

Ming Zhang

GRADUATE STUDENT TEACHING AWARD

This award is given to a Biological Sciences graduate student for their service to the department with regards to teaching.

The following student was awarded the Graduate Student Teaching Award for 2014–2015:

Pieter Spealman

ELIZABETH W. JONES AWARD for Excellence in Undergraduate Research in Experimental or Computational Biology

To honor her commitment to undergraduate research, the Elizabeth W. Jones Award was created in 2009. This award is given to honor the research efforts of a talented and dedicated undergraduate over their years at Carnegie Mellon.

The following student was awarded the Elizabeth W. Jones Award for 2013–2014:

Anthony Spadaro

ProSEED GRANTS

The following faculty members were recipients of ProSEED Simon Initiative Seed Grants:

Maggie Braun (PI) (DJ Brasier, Jonathan Jarvik, Fred Lanni, Javier Lopez, Brooke McCartney, Mohamed Bouaouina, Jonathan Finkel, Jonathan Minden, Gordon Rule, Ken Hovis)
Gordon Rule, Jonathan Minden, Javier Lopez

The following faculty members were recipients of ProSEED BrainHub Seed Grants:

Alison Barth, Aryn Gittis, N. Luisa Hiller, Sandra Kuhlman, Brooke McCartney, Aaron Mitchell

DR. MARGARET CARVER TRAVEL AWARD

Each year, a group of Biological Sciences doctoral students are granted travel awards by the department. These scholarships are used by the students for professional reasons, such as attending conferences or furthering their research at an external location. The travel awards are made possible through the generous contributions of the late Margaret Carver, M.D. (MM '43).

The following students were recipients of the Dr. Margaret Carver Travel Award for 2014–2015:

Malachi Blundon

Berquin Feese

Ezgi Kunttas-Tatli

Olivia Molinar

Stacie Oliver

John Pettersson

Sahil Sangani

Amanda Willard

SEMON H. STUPAKOFF FELLOWSHIP

The Semon H. Stupakoff Fellowship is awarded to a graduate student every year for the impact and quality of his or her recent publications. This fellowship began in 2012 and was named after alumnus Semon Stupakoff.

The following student was awarded the Semon H. Stupakoff Fellowship for 2015:

Tanvi Shashikant

GLEN de VRIES FELLOWSHIP

The de Vries Fellowship is awarded to a graduate student every year in recognition of his or her outstanding promise in biological research. This fellowship began in 2012 and was made possible through the generosity of Glen de Vries, alumnus and founder of Medidata Solutions.

Glen received his B.S. in Biological Sciences with options in molecular biology and genetics from Carnegie Mellon University, worked as a research scientist at the Columbia Presbyterian Medical Center and studied computer science at New York University's Courant Institute of Mathematics.

The following student was awarded the de Vries Fellowship for 2015:

Dan Shiwarski

Exploring the Science Classroom

Teaching strategies and technological tools embraced by the Biological Sciences faculty

WRITTEN BY MATTHEW SALYERS

Science has always been about examination and experimentation. The science classroom is no different. There has been an upsweep of change occurring in biology classrooms around the country, from the way students are involved in class discussions to the way instructors deliver the information. More and more faculty members have started to introduce an active approach to learning that engages students with practical applications and activities in the classroom.

In the Department of Biological Sciences, this approach has been adopted in numerous courses, both at the undergraduate and graduate levels, as a way to further propel our department as a leader in biological studies. Faculty members have accepted the challenge to examine their teaching techniques and find ways to enhance their classrooms with active learning approaches and technological tools to better suit the needs of the modern academic community.

ProSEED GRANT FOR ACTIVE LEARNING STUDY IN INTRODUCTORY BIOLOGY

As one of twelve inaugural recipients of CMU's ProSEED grant program, which began in 2014 as an initiative of President Subra Suresh to provide seed funding to improve the quality of life at the university and continue the flow of new ideas and experimentation, Maggie Braun hopes to expand on the department's already growing use of active learning techniques and broaden their implementation in all introductory biology courses.

"There's a big movement nationwide, supported by the government and organizations like the Howard Hughes Medical Institute and the National Academy of Sciences, to get more biology faculty at the college level involved with these active learning techniques," said Braun, assistant teaching professor of biological sciences and assistant head for undergraduate affairs in the department.

Instructional methods involving active learning approaches have been shown as a way to keep students engaged and provide them with problem-solving and communication skills that will greatly enhance their academic and professional careers. These approaches range from in-class activities and literature-based discussions to instant feedback from classroom clickers (where anonymous answers from all students in the course can be collected and displayed in real time) as well as modified lectures based on student feedback before each class.

The main goal of Braun's ProSEED funded project, "Bringing Scientific Teaching to Introductory Biology", is to bring more active learning to all the introductory courses in the department, which included eight different classes taught by nine different professors on two different campuses at the time of conception. In order to formulate a long-term plan, the project leaders needed to collect data to gauge what methods of teaching were being done in the current biology courses, and what works best for students at Carnegie Mellon.

Braun, along with Shanna Bowman (Bowersox), Ph.D. candidate and executive TA for this project, set up pre-course and post-course tests for students in each of the introductory classes, both at the Pittsburgh campus and at CMU-Qatar, to form a benchmark as to how comfortable students were with biological concepts coming into the class. These assessments also measure student retention of the content of each course. Braun and Bowman hope to be able to show a connection between the use of the different active learning techniques and student learning outcomes by comparing active classrooms to those that use traditional lecture approaches.

The response rate of the students was exceptionally high, with over 80% in the selected courses electing to take part in the study, leading to a greater yield of quality data. Braun will begin to analyze her findings in the coming summer once post-course information has been collected

from spring courses to see if the learning gains and knowledge retention are increased by active learning approaches, which has been the finding in other studies across the country.

Once the data sets have been analyzed, Braun hopes the faculty will look at how the department can introduce these approaches and activities into more courses across the curriculum, and discuss which approaches work best in each individualized classroom setting -- from large format lectures with 200 students to small classes with fifteen students.

"Our goal as instructors is to create a space for students to feel comfortable asking questions and let them know how they can find an answer," Braun said. "Instructors don't always have all the answers either, especially in research. But how would I find the answer if I don't know it? That's how we can show our students how a biologist thinks."

MODERN BIOLOGY

While textbooks and lectures provide students with the information and concepts needed in many traditional courses, there are other ways to actively engage students. In biology, critical evaluation of primary scientific literature is common in advanced courses, but introducing students to these readings even earlier can assist beginning majors and non-majors alike with understanding the applications of the fundamental principles in real-word scenarios.

DJ Brasier, assistant teaching professor of biological sciences, has put this theory to practice in his Modern Biology course. The proposal to overhaul the learning approaches of this course acted as a continuation of a paper he published in 2014 with Biological Sciences graduate student Amanda Willard, titled "Controversies in Neuroscience: A Literature-Based Course for First-year Undergraduates that Improves Scientific Confidence While Teaching Concepts." For the proposal, Brasier was awarded a Wimmer Fellowship, made possible by a grant from the Wimmer Family Foundation, through CMU's Eberly Center. Recipients of the fellowship work with Eberly Center colleagues to design or re-design a course using new technological or pedagogical approaches.

Brasier felt that giving students a chance to read original scientific research papers early in their college careers would not only aid in their understanding of the biological concepts of the course, but also let the students practice invaluable critical thinking and communication skills. With a class of 180 students, comprised of roughly forty potential biology majors, fifty potential majors in other sciences, and ninety upperclass students with non-science majors, Modern Biology

DJ Brasier, Ph.D. leading a class discussion

encompasses an array of undergraduates with varying degrees of biology backgrounds.

"It can be very overwhelming for students to be given a paper that's written primarily for a technical audience," said Brasier, who understood that such a diverse class would need other tools at their disposal in order to succeed. So along with the assignments of primary scientific literature, Brasier implemented a "just-in-time" teaching approach, which requires students to read material before each lecture and complete short assignments to go along with each reading. The assignments can then be read over by the instructor and that day's lecture can be adjusted to focus on the concepts that students seem to be struggling with rather than information that the class easily grasped.

"Having these questions next to them can give student some guidance in the reading and in the understanding of the papers," Brasier said. "This can help me manage their expectations."

When the re-design of his Modern Biology course was originally conceived, all of the assigned readings took the form of individual activities. It then evolved into both individual and group work, with some of the more difficult readings assigned with groups to let students help each other in their understanding of the information and build better communication skills in explaining complex scientific principles.

The use of primary literature in an introductory biology course exceeds its goals, giving potential majors and even non-majors a taste of biology

that they may not have come across before. "Biology has its own creativity and its own way to explore and think critically," said Brasier.

APPLIED CELL AND MODERN BIOLOGY

As a required course for incoming non-biology majors into the Master's in Computational Biology program, Applied Cell and Molecular Biology aims to provide a foundational biology background for all students in the program with the required ability to design strategies for biological experimentation and to interpret data derived from these analyses.

More than half of the students in the master's program arrive with non-biology degrees, which means their knowledge of the basic concepts of biology are at drastically different levels. Shoba Subramanian, assistant department head for graduate affairs and assistant teaching professor of biological sciences, has evolved this course to best prepare students in the program with the necessary skills to understand the reasoning for applying computational tools to biological data sets.

"My goal is for the students to understand and appreciate how the biological data were obtained," said Subramanian, "and what went into the strategic design and implementation of the experiments that produced these data and what the data mean toward furthering our knowledge of biological pathways."

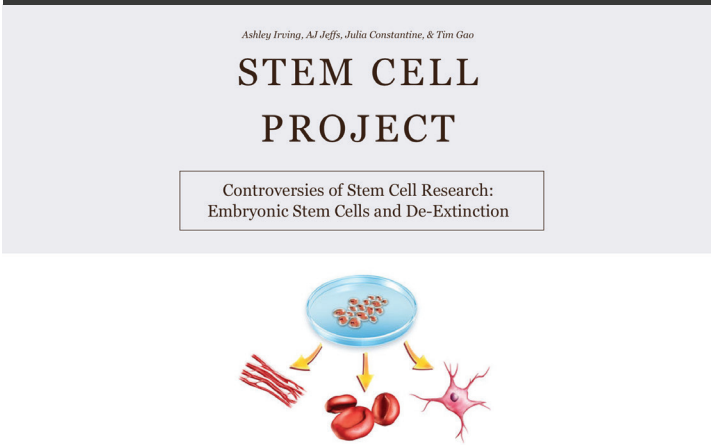
Working with the Eberly Center for Teaching Excellence as a Wimmer Faculty Fellow in fall 2014, Subramanian employed several strategies of active learning pedagogy to make sure all the students in the course were effectively engaged throughout the semester, thus playing a crucial role in their own learning. A "just-in-time" teaching approach had students read book chapters before class and not only answer questions based on the reading, but also provide questions about the reading to the instructor via Blackboard. Subramanian would then go through all the answers and questions the morning of each class to tailor the lecture and discussion to focus on the pertinent questions raised by the students.

"By putting students' questions on the PowerPoint slides during my lectures, they felt like their time was valued and their questions were being answered," Subramanian said.

In addition to adjusting lectures based on student feedback, a strong emphasis has been placed on group-learning activities, with students working in-group or with partners on various tasks in class, and on understanding and analyzing scientific papers. The final exam is verbal -- not common in many science courses -- and lets the students expand on their ideas and knowledge in a dialogue with the instructor. Subramanian had each student, in around 45 minutes, design and explain an experimental approach and predict outcomes that dealt with a biological problem given to each student at the start of the final.

"In one semester, the course goes from basic biology to the students being able to critically read scientific papers," said Subramanian. "It's very hard to do this in one semester, and finding the best way to get them there in such a short amount of time was my major motivation for changing how the course was taught."

Section of a website created as a final project in Brooke McCartney's Basic Science to Modern Medicine course. Project designed and created by Ashley Irving, AJ Jeffs, Julia Constantine & Tim Gao.



BASIC SCIENCE TO MODERN MEDICINE

Saying that biology affects your life every day is perhaps an understatement. From what happens inside your body, to work in labs and hospitals, biological concepts are happening everywhere. In Brooke McCartney's course for non-biology majors, Basic Science to Modern Medicine, she hopes to equip her students with an understanding of basic biology and its application to their lives.

"I want to bring biology to non-biologists," said McCartney, associate professor of biological sciences. "Biology is an essential component of their education and of their lives, and an understanding of biology can help make them be responsible, educated citizens. These are the kinds of citizens who can vote on an issue pertaining to science and understand it, or go with their parents or loved ones to the doctor and help make informed decisions regarding health care."

The course, developed last year, is centered around three topics of discussion and analysis -- cancer, stem cells, and the microbiome. Students immediately interact with these concepts in a "flipped classroom." Students prepare for each class online beforehand using

a variety of resources including The New York Times, TED talks, and articles from the primary scientific literature. Instead of lectures, class time reinforces the key points from the assigned activities and asks students to apply what they have learned through in-class projects and problem solving that takes the form of individual work, partnered projects, and group activities.

"A flipped classroom requires strong student participation," said McCartney. "They must be actively engaged with biology each and every day."

With an interactive and problem-solving-based class environment, McCartney utilizes a collaborative teaching cluster (CTC) in the university's Wean Hall. Everyone has their own computer station, so there's no need to remind students to bring their laptop to class each day or worry whether a computer is charged or connecting to the internet. The ready-to-be-implemented technology enables biological discovery and problem solving to take center stage.

Along with work in class, projects are a core of each student's evaluation. A final project, which focused on stem cells in the last incarnation of the course, challenged students to work in teams to present information about stem cells in a way that non-scientists would find engaging and understandable. Anything was possible for the project, and previous teams designed interactive websites, videos featuring puppets, radio programs in the vein of This American Life and Radiolab, and even a board game.

Working with the Eberly Center to define the strategies and approaches that would be most suitable for a flipped classroom, McCartney produced a course that put the keys in the hands of her students to successfully drive their understanding of themselves and of the world around them.

"Several students who took the class shared with me that their new biological understanding has helped them be successful in a summer internship, engage with science in the news, and even help a parent connect basic genetics and health care decisions," said McCartney. "They're using their education, and that is incredibly rewarding to see."

HOW BIOLOGICAL EXPERIMENTS WORK

Originally conceived in 2011 as a course where students created storyboards for the production of videos to explain the underpinnings of certain biological experiments, "How Biological Experiments Work" is a freshmen class composed of a dozen students that now produces full-fledged videos.

Taught by Jon Minden, professor of biological sciences, the class has students work in groups to produce films that explain fundamental concepts in biology. These foundational videos are then followed up by videos that explain experiments pertaining to the concept. The knowledge about these topics is fresh in the minds of the first-year students, and this visual learning/teaching method helps cement the science they may have just learned in the previous semester.

When first offered, high-quality equipment wasn't readily available to all students taking the class, but now, with smartphones capable of capturing high-definition video, they can record videos by simply reaching into their pockets.

The course has students work in groups of four, taking the roles as director, writer, artist, and actor. Minden sees students coming to his course with much more filmmaking experience, as most high-schoolers have made videos in classes or for YouTube. And as a project oriented course, the teams must take their own initiatives to schedule group time outside of class.

"Having to really focus on one subject area very intently is an important aspect of this course," said Minden, "but I think another big part is working with a team."

As students create their short videos, most coming in at around five minutes, their creativity is the only limit to how they choose to explain

A meeting of the Teaching Journal Club. Pictured (left to right): Shoba Subramanian, Ph.D., Maggie Braun, Ph.D., DJ Brasier, Ph.D., and Emily Drill, Ph.D. Not pictured: Carrie Doonan, Ph.D., Karen Thickman, Ph.D., Linda Visomirski-Robic, Ph.D., Swarna Mohan, Ph.D., and Jason D'Antonio, Ph.D.

these scientific concepts. Each group that Minden has worked with has produced something unique, including but not limited to music videos and stop-motion animation.

OPEN LEARNING INITIATIVE

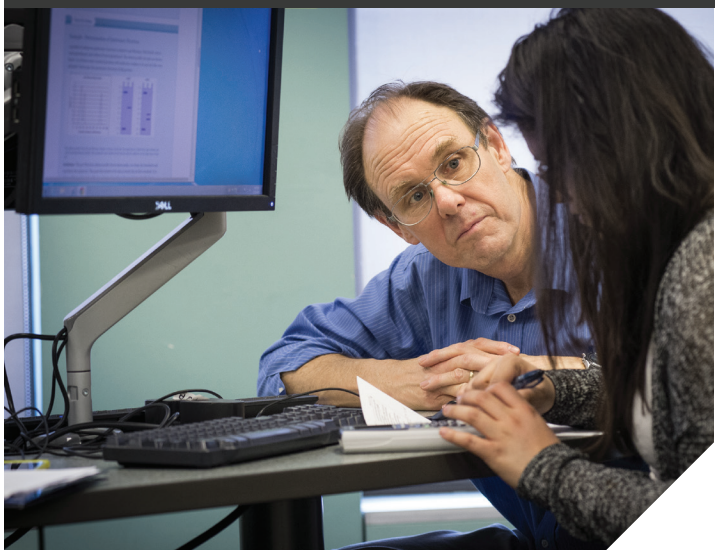
The Open Learning Initiative (OLI) is a grant-funded group at Carnegie Mellon University, offering an online learning platform and courses to anyone with access. Gordon Rule, professor of biological sciences, has worked to create Modern Biology and Biochemistry courses that contribute original research to improve learning and transform higher education.

The project began with the late Bill Brown, professor of biological sciences, who was approached to construct an OLI course for Modern Biology. Rule completed the course module after Brown's passing in 2007 and expanded the project with the creation of a Biochemistry course within the OLI. The online courses offer students enriched reading and exercises, combining interactive cellular animations and embedded videos to go with assignments.

Within the OLI, a digital dashboard allows instructors to keep track of students' grades and also extrapolate their answers on a larger scale.

"As an instructor, you can identify key concepts associated with individual questions," said Rule, "and the dashboard can take students' responses and map them to the concepts. So you're no longer just looking at how students did on a single question, but how they are understanding the concepts."

Gordon Rule, Ph.D. assisting undergraduate student with OLI learning module in Biochemistry



Recently mentioned in a New York Times article about the ways colleges are reinventing classrooms to keep more students in science, the OLI is used not only at Carnegie Mellon University in a wide-variety of courses, but also at universities across the globe. In fact, the initiative has become the most heavily used learning platform in colleges and universities in the world.

The concept of the Open Learning Initiative came from the idea of integrating Carnegie Mellon's expertise in cognitive tutoring into whole online courses that would stand on their own and enact instruction. Its role in changing the science classroom is only just beginning to take shape, and it's giving students and instructors a digital forum for highly interactive learning.

EBERLY CENTER

For over thirty years, the Eberly Center for Teaching Excellence and Educational Innovation has been a resource on campus for helping faculty, postdocs, and graduate students refine their course objectives and instructional methods to best complement the collegiate learning process.

Colleagues within the center work closely with instructors to tackle the question as to what learning techniques work best for each individualized course. Active learning approaches, which involve low-stakes practice at applying learned concepts and immediate feedback to the application, have been a focus in course development as an alternative or supplement to the more traditional lecture-based class.

"Students are able to retain more with active learning and are better able to apply that knowledge in specific situations," said Chad Hershock, director of faculty and graduate student programs at the Eberly Center.

With the growing amount of options from the technological side of teaching, the Eberly Center also helps instructors see which technologies would be most beneficial to a certain learning module and what these technologies would look like.

"Data is compelling for faculty," Hershock said. In working with instructors, the center can leverage their large evidence base to help synthesize and apply effective techniques, advocating what has been proven to work and why it is shown to be an effective teaching tool. The center's goal is to support teaching, and in turn, support students in providing the greatest return on their educational investment.

Introducing: A New Major in Neuroscience

WRITTEN BY DJ BRASIER & MAGGIE BRAUN

Over the past several years, the offerings in neuroscience have expanded significantly in several departments and centers on campus, including Psychology, Biological Sciences, Statistics, Computer Science, Biomedical Engineering, Social and Decision Sciences, and the Center for the Neural Basis of Cognition. As neuroscience matures as a field and becomes more visible in the popular press, undergraduate students at Carnegie Mellon have increasingly been drawn to studying the brain. Therefore, working in close collaboration with the Department of Psychology and the Center for the Neural Basis of Cognition, the Department of Biological Sciences created a Neuroscience undergraduate major that is being offered for the first time this academic year.

The major draws on the three core areas of neuroscience that had previously been represented in minors that were already available on campus: neurobiology, cognitive neuroscience, and computational neuroscience. Students majoring in neuroscience take a core set of math, natural science, and life sciences courses while also completing a core neuroscience-focused curriculum that includes coursework across neurobiology and cognitive and computational neurosciences. Students then pursue their degree concentration through their upper level electives.

This major represents one part of a growing number of close connections between MCS and the other colleges on campus. In addition to the joint offering with Psychology, the major is part of a larger set of collaborations that are being developed with many departments on campus through the BrainHub[SM] initiative. Already, the University has committed ProSEED funds to three collaborations involving faculty from Biological Sciences. One brings Aryn Gittis and Sandra Kuhlman together with Biomedical Engineering faculty to develop more advanced neuroprosthetic devices. The second funded project supports Brooke McCartney, Luisa Hiller, and Aaron Mitchell as they work with computational biologist Carl Kingsford to understand how the Drosophila gut microbiome affects gene expression in the fly brain. The third project, led by Alison Barth and computational biologist Ziv Bar-Joseph, aims to understand and model how neural synapses are "pruned" during development for stability and improved memory and learning. The neuroscience major reflects the growing collaborations of our department and also provides our undergraduate students new avenues to take diverse courses in brain science from many of these departments. Given the strong support for brain-related research on campus, students will also have increased access to opportunities to become involved with neuroscience research projects.

BrainHub[SM] is a new initiative focusing on understanding how the structure and activity of the brain give rise to complex behaviors. CMU scientists and their global partners including Sun Yat-sen University in Guangzhou, China; the Indian Institute of Science in Bangalore; and Oxford University and the University of Warwick, in the U.K., will work together, along with CMU's long-time collaborators from the University of Pittsburgh, to develop innovative computational and technological tools for studying the links between brain and behavior, enabling new insights into topics such as cognition, learning and perception, as well as shedding light on brain disorders such as autism and Parkinson's disease. Beyond basic research, BrainHub will also promote the dissemination and commercialization of the most promising of these advances so that they are widely used, furthering brain research, policies and practices across the globe.

Qatar Comes to Pittsburgh

WRITTEN BY
F. ZAMRA ZAHIR & MASHA OSMAN

HHMI Summer Research Institute (SRI)

Ever since joining Carnegie Mellon University-Qatar, I have sought out exposure to research not only because I am passionate about it, but also because it would be highly beneficial for becoming successful in my professional dream, which is medicine. Having been exposed to research during Phage Genomics and Modern Biology coursework, I was very excited to take my training to the next level by working with advanced scientists at our Pittsburgh campus. I was extremely thrilled in spring 2014, when I received the letter that I had been selected into the Summer Research Institute (SRI) in the main campus at Pittsburgh.

The SRI, hosted by the Department of Biological Sciences funded by the Howard Hughes Medical Institute (HHMI), provided me with the opportunity to perform hands-on research upon the completion of my freshman year in summer 2014. I applied to the program not knowing what to expect, but after having finished the program, I cannot be more grateful for this opportunity, which in addition to exposing me to real research and top scientists, has also helped me in making new friends and connections, all of which will have a positive impact throughout my life.

During the first two weeks of the ten-week program, we had boot-camp style training in basic cellular and molecular laboratory techniques, ranging from bacterial transformations, to isolating, purifying, and characterizing proteins. We wrote extensive lab reports on not just the methods and results, but also had the chance to discuss critically alternative strategies and troubleshoot ideas where applicable. Following this intense, but rather valuable two-week period, we broke into teams of three students to carry out independent research.

At the end of the boot camp, Maya Holay and Emilio Rodriquez, both from the main campus, and I were assigned a new and exciting research project involving the gut microbiome and brain connection. Two fellow CMU-Qatar students were also participating in the SRI program in 2014. Safa Salim and her team were studying gene expression in regenerating starfish larvae and comparing it with that in normal growth, while Ettaib El Marabti and his group were studying the effect of altered gravity on embryo development and protein expression in fruit flies.

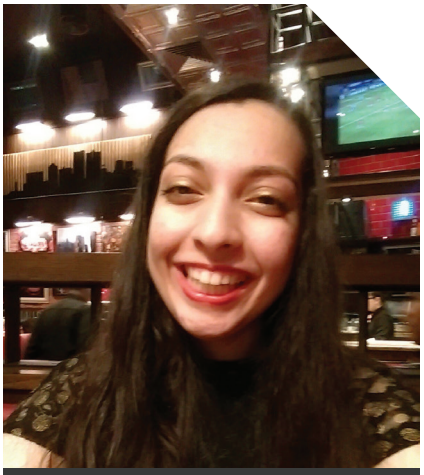
My team worked under the mentorship of Brooke McCartney and her graduate student Stacie Oliver. We studied the connection between the gut microbiome and brain function of the fruit fly. Our excitement in carrying out this research project was reflected in our enthusiasm for countless repeats we performed in attempting to get consistent results. The model organism we used for our project was *Drosophila melanogaster*, commonly known as the fruit fly, because they are relatively easy to manipulate. The microbiome (the flora of bacteria in the gut) of *Drosophila melanogaster* was manipulated in order to investigate behavioral and biological changes due to a varied microbiome. We concluded that a decrease in the microbial load decreases the fruit fly's perception to gravity and decreases it's capacity to learn and remember certain behaviors. This study, along with many other related ones, leads us to believe that manipulation of the microbiome may help us treat neurological conditions such as depression, anxiety, and autism in humans.

My main learning during the summer was that patience and perseverance is key to success, and that there are more failures than successes when it comes to research. Since our topic was new and evolving, we did not have a step-by-step manual available. The challenge was to develop our own protocols based on previous studies. Because of this, we faced quite a lot of problems in our experiments that required many modifications. There

were many times when the results would not meet our expectations, and so we had to collaborate to troubleshoot and develop new strategies to solve the problem. As a rising sophomore, by experiencing the disappointments and the rewards of research, I discovered what it is like to be a research scientist.

Being an undergraduate student, I feel that this remarkable experience has challenged me in new ways and has allowed me to understand scholarly articles and published works of research more in-depth. It has further refined my skills in balancing collaborative and individual work. I believe that the skills I gained in this experience will be of immense benefit to me when I carry out more research and attend medical school. This valuable experience also afforded me the opportunity to work closely with the main campus faculty, who have deep and diverse interpretations of biology and medicine, which will eventually help me in choosing a field of research and medicine to specialize in. **– F. Zamra Zahir (B.S. ′18)**

CMU-Qatar undergraduate students & HHMI Student Research Institute (SRI) participants Safa Salim, Ettaib El Marabti, and Zamra Zahir



CMU-Qatar undergraduate student & HHMI summer researcher Masha Osman

HHMI Summer Researcher

I spent the better part of last year in Pittsburgh for two very special reasons, one being that I was accepted into the HHMI Summer researchers program and the other because I spent a semester studying abroad at CMU's main campus. During the summer, I was able to conduct research in a faculty lab at CMU-Pittsburgh for about 10 weeks. Working on a novel project to study the effects of metal-ion binding on the dynamics of the protein-DNA complex (complicated, I know); I was introduced to a more hands-on experience in the lab.

For the majority of my undergraduate career, I had only been able to apply the skills I learned in class to lab courses, so when this summer research opportunity came along, I jumped at it. Initially, I wasn't too keen on the idea of conducting research – it bored me and I just wanted to skip straight ahead to medical school. However, working in my professor's research lab and making meaningful progress in the experiment at hand caused me to reconsider my stance on research and even consider pursuing a career as a physician-researcher. That being said, my seven months in Pittsburgh really allowed me to focus my near-future goals with regards to medical school, research experiences and the specific field I would like to specialize in – pediatrics! In fact, I am going to spend this coming summer performing research in the same faculty lab to see how far the project I was working on has come, and to play a role in furthering it as well.

Also, I will be spending my final year on main campus completing a degree in a different major – BioPsych (or Biological Sciences/Psychology). With this major, I will be able to take courses that are more closely tailored to pediatrics, such as child development and behavior courses – something extremely beneficial to me in the long run. Pittsburgh has provided me with a lot of opportunities and also exposed me to a culture different from that in which I was raised. Both the diversity on main campus and the chance to explore my surroundings freely and learn more about different states in the US were two characteristics that played a key role in shaping my goals for days to come, and as a result, I loved every minute of my time there. **– Masha Osman (B.S. ′16)**

A Graduated Conversation

Talking with alumna Yiping Zhan

INTERVIEW BY SHOBA SUBRAMANIAN

Yiping Zhan

(Ph.D. '04)

Ph.D. Thesis Advisor: Gordon Rule, Ph.D.
Thesis Title: *NMR Studies of Human Glutathione Transferase A1-1 and sar, a Small Antisense RNA*

Staff Bioinformatics Scientist
Thermo Fisher Scientific (Ion Torrent)
2014 – 2015

Senior Statistical Geneticist II
Affymetrix
2007 – 2014

Statistical Genetics Analyst
Perlegen Sciences
2005 – 2007

Senior Postdoctoral Research Associate in Bioinformatics
University of Massachusetts
2004 – 2005

Could you talk about your overall career that ultimately guided you to your current position?

I went to graduate school fresh out of college and frankly I was not totally sure about my future career at first. I enjoyed doing research in the lab as an undergraduate student and I decided to do more of it in graduate school. It wasn't until several years into my graduate studies that I realized working on analysis of interesting biological data was what I really wanted to do. At that point I had some exposure in my graduate work on solving a number of computational problems and became confident with what I could do. The biotech industry keeps providing new technologies for helping to answer interesting biological questions, so I was attracted to the possibility of working in industry to contribute to the development of such technologies and data analysis methods. Later on things worked out for me and that's how I ended up in my current position.

What is the nature of your current job?

Technologies like DNA microarrays and next-generation sequencing (NGS) are changing the field of genetics, cancer biology, and clinical diagnosis, thus there is a constant need for new methods to be developed to analyze new data. I work on developing methods for solving problems in the analysis of such biological data, both to support technology development and to help with getting the most out of the data for research and clinical use.

When you started in the Ph.D. program did you have a strong sense for what career you wanted? Did it change?

I was initially thinking of a career in academia. However, over the years in graduate school I became more interested in further working in the area of technology development and solving the computational problems these technologies were bringing forward within the context of answering biological questions. I realized that working in industry could allow me to pursue these interests, so by the end of my Ph.D. studies I decided to try to go for a suitable position in the biotech industry.

How did your CMU training influence/strengthen your career choice?

My graduate research involves quantitative data analysis in molecular structure-function interconnection. Since suitable tools for such analysis were not always directly available, I needed to develop some on my own. Throughout the process I got a tremendous amount of support and encouragement from Gordon Rule, my Ph.D. advisor, and I ended up deriving much pleasure and confidence in solving these quantitative problems in an efficient and satisfactory way. Over time I saw that using computational methods to solve problems in biology is something I am good at and also enjoy doing. So I made up my mind to leave academia eventually and try to do more of the work I like in the biotech industry.

How do you use skills that you obtained during your CMU training in your current position?

I had the chance to be involved in the development of some computational tools in my graduate studies at CMU, including implementing the GUI of an in-house software for NMR resonance assignments and a small tool to fit dynamics parameters based on NMR ligand titration experiments. Taking advantage of courses and programs at CMU I was also formally introduced to machine learning

and data mining as well as general computer science. Having a solid background in both biology and computer science is crucial for a deep understanding of the type of problems I need to solve in my current position and is invaluable in choosing suitable analysis approaches.

Do you have any words of wisdom for current students looking for jobs outside of academia?

It took me quite some time to realize what I enjoy doing the most. For me that was the important first step. After that I believe being proactive is a must, since going for a career in academia is sort of the default for most Ph.D. graduate students in the field of biology. If one is interested in a career outside of academia, seeking the necessary information and achieving the right set of skills may take some effort. I found that having a clear goal and a positive attitude helps a great deal.

Editors note: Since the interview in March 2015 Yiping has taken up a position with a non profit company, Foundation for the Assessment and Enhancement of Embryonic Competence based in New Jersey.

ALUMNI UPDATES

Shreya Aggarwal (B.S. '07) and **Mayur Parepally (B.S. '06)** were married in September of 2014 in Houston, Texas.

Brett Benedetti (Ph.D. '10) has started a new position as assistant editor at Nature Medicine, based in the Nature Publishing Group offices in New York, NY. There, he is the research manuscripts editor responsible for handling the majority of neuroscience content.

Tamara Berdyyeva (Ph.D. '08) is currently working as a scientist in the Neuroscience Department at Janssen Pharmaceuticals Inc.

Melissa Lee Bruner (B.S. '09) transitioned from her former position as a senior analyst in Johnson & Johnson to a new role as a vice president in Risk Management for the Commercial Group at Citibank. She was recently married in October 2014 to CMU alumnus Eric Bruner.

Sheila Chandran (M.S. '13) is currently an associate computational biologist at Broad Institute. Prior to this, Sheila worked as a biotech project manager at EpiVax in Rhode Island after graduating.

Danielle Eytan (B.S. '09) recently finished a one year research fellowship at the National Institutes of Health, where she studied novel therapeutic agents for head and neck cancer. Danielle will graduate from medical school at the Cleveland Clinic Lerner College of Medicine of Case Western Reserve University this May, and start residency training in otolaryngology-head and neck surgery this July.

Michael Gamalinda (Ph.D. '14) began his postdoc at the Max Planck Institute of Immunobiology and Epigenetics in 2014, and also won the Alexander von Humboldt Postdoctoral Fellowship. In addition, he received the prestigious Marie Curie International Fellowship for postdoctoral researchers.

Kyla Graham (B.S. '11) started working for Agilent Technologies as a manufacturing chemist in the nucleic acid solutions division after completing an M.S. in toxicology from Colorado State University.

Yusong Guo (Ph.D. '09) works as Assistant Professor in the Life Science Division at Hong Kong University of Science and Technology. He has two sons, Aiden and Nathan.

Alys Jarvela (Ph.D. '14) is now a postdoctoral fellow in the lab of Leslie Pick in the University of Maryland Department of Entomology beginning in March 2015.

Vineet Joshi (M.S. '14) accepted a position as computer programmer at Eureka Genomics in Hercules, California .

Anne Killeen (B.S. '84) was recognized in 2014 by The Wall Street Journal/Real Trends as one of the TOP Agents in the Nation. Killeen enjoyed 30 years of a successful career helping people buy and sell their homes in the greater Washington, DC/ Maryland area. In her off time, she raises funds for the Leukemia and Lymphoma Society by participating in their Team in Training program.

Ezgi Kunttas-Tatli (Ph.D. '14) entered a postdoctoral position with Marianne Bronner at the California Institute of Technology.

William Mackey (Ph.D. '85) has worked as director of quality in a molecular toxicology company, and held three full-time university appointments at Saint Anselm College, Angelo State University, and Edinboro University. Bill has resided in Edinboro, Pa. for the past 16 years with wife Annette and daughter Caroline, who are now both in graduate school at Duquesne University.

Ken Miller (Ph.D. '95) recently finished his 10th year at MedImmune working in the Department of Analytical Biotechnology and will be celebrating the 20th anniversary of receiving his Ph.D. from the Department of Biological Sciences this spring.

Parul Nisha (Ph.D. '07) has completed two post-docs (NIDDK, NIH and Children's Hospital of Pittsburgh, University of

ALUMNI UPDATES

Pittsburgh). Parul currently lives in Pittsburgh and has recently started at a clinical research associate position with Philips Healthcare out of Monroeville, Pa. and is busy raising two children, Prakhar and Kushagra.

Shannon Quinn (M.S. '10) graduated from the University of Pittsburgh with a Ph.D. in Computational Biology, and has accepted an assistant professor position at the University of Georgia with joint appointments in the departments of Computer Science and Cellular Biology.

Nina Senutovitch (Ph.D. '11) will be returning to her postdoc at the University of Pittsburgh in April, and is currently working at the Pitt Drug Discovery Institute with Dr. Lansing Taylor developing "human liver on a chip" technologies for toxicology evaluation. Nina recently welcomed a son, Joaquín.

Alan Shteyman (M.S. '14) entered the Biological Sciences Ph.D. program at Carnegie Mellon University after completing his masters.

Max Tomlinson (M.S. '13) has accepted a position as a bioinformatician doing research in the Dudley Lab at the Icahn School of Medicine at Mt Sinai in NYC.

Priyanka Venkatesh (B.S. '11) recently graduated from Cornell's Biomedical Engineering Department with a masters and completed a thesis project on building a new transcranial magnetic stimulation. Priyanka is currently living in Manhattan as a design engineer for the company Humanscale, doing a mix of mechanical engineering and a bit of design.

Christine Wang (Ph.D. '06) is now a project manager at a pharmaceutical company, where she is in charge of process R&D, GMP production in new drug development. Prior to this, she completed a post-doc at Baylor College of Medicine in Houston and another at Academia Sinica in Taipei, Taiwan.

Peter Ward (B.S. '96) began collaborating with a company to create a line of tactile medical education models that replicate the look and the feel of injured joints and ligaments, allowing medical and other health professional students to learn how to sense a positive finding during the physical examination. Peter and wife welcomed twins 18 months ago.

Aaron Mitchell Awarded 2015 ASM Graduate Microbiology Teaching Award

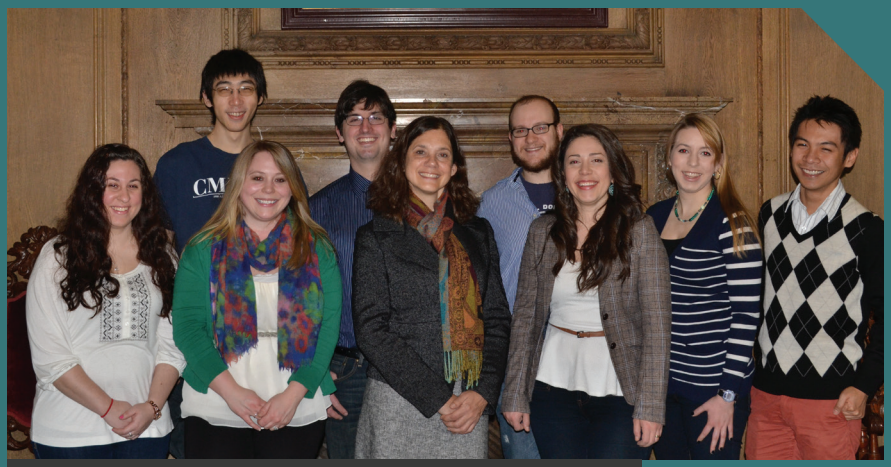
AMERICAN SOCIETY FOR MICROBIOLOGY

Written by Matthew Salyers

Aaron Mitchell, professor of biological sciences, has been selected to receive the 2015 American Society for Microbiology (ASM) Graduate Microbiology Teaching Award. The award honors exemplary teaching and recognizes an individual for distinguished teaching of microbiology and mentoring of students at the graduate and postgraduate levels and for encouraging students to subsequent achievement.

Past winners have included Jo Handelsman, associate director for science at the White House, Jonathan Beckwith, American Cancer Society Professor of Microbiology and Molecular Genetics at Harvard Medical School, and Stanley Falkow, Stanford microbiologist and recipient of a Lasker Award for medical research.

The Department of Biological Sciences congratulates Aaron Mitchell for his continued excellence in mentoring.



(left to right): Amanda Willard, Ming Zhang, Shanna Bowman, Chris Pratt, Guest Speaker Marina Picciotto, Ph.D., Philip Davidson, Ezgi Kunttas-Tatli, Karen Kormuth & Michael Gamalinda

Students Invite Speakers

Written by Karen Kormuth, SISS Chair

Each semester, weekly departmental seminars given by visiting professors inform us of the latest scientific breakthroughs, often before these results are made available to the public! However, these visits are quite brief, limiting direct exposure of graduate students to these established researchers. The primary goal of the SISS committee, an interdisciplinary group of biology Ph.D. students, is to close this interaction gap by hosting several yearly seminars. We solicit speaker nominations from our peers and organize meetings exclusively reserved for students. These meetings allow access to the best minds in science, providing valuable insights on topics ranging from the newest technologies to advice for navigating a scientific career. With the guidance of our advisor, John Woolford, SISS has flourished. Recent speakers include several of the most influential and celebrated modern scientists such as Tom Maniatis, Ph.D. of Columbia University and Andrew Fire, Ph.D. of Stanford University. Additionally, we recognize the diversity of the scientific community by selecting accomplished researchers to present annual WIS (Women In Science) seminars. Recent WIS invitees have included Denise Montell, Ph.D. of the University of California, Santa Barbara; Marina Picciotto, Ph.D. of Yale University; and Catherine Dulac, Ph.D. of Harvard University. Together, these speakers have allowed us to establish a distinguished seminar series that will continue to benefit our graduate students into the future.

THE PROMOTER

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CONNECTING OUR PAST WITH OUR FUTURE

Alumni – Does your lab have current opportunities for postdocs? Is your company looking for qualified students for internships or recent graduates for open positions?

Connect with the Department of Biological Sciences and we can announce these opportunities to our current students.

Email bio-jobs@andrew.cmu.edu

"Teamwork is the ability to work together toward a common vision. The ability to direct individual accomplishments toward organizational objectives. It is the fuel that allows common people to attain uncommon results." – Andrew Carnegie

IMAGE & PHOTO CREDITS

Page 4–5: Courtesy of the Department of Biological Sciences and the Hiller lab. Page 6: Courtesy of the United States Air Force. Page 8–9: Courtesy of Madhumitha Ramesh and Mellon FIT. Page 13: Courtesy of Tim Kaulen, DJ Brasier and his Systems Neuroscience class. Page 15: Courtesy of the Department of Biological Sciences and the Teaching Journal Club. Page 16: Courtesy of Tim Kaulen, Gordon Rule and his Biochemistry class. Page 17: Courtesy of BrainHub. Page 19: Courtesy of Zamra Zahir and Masha Osman. Page 20: Courtesy of Yiping Zhan. Back Cover: Courtesy of the Department of Biological Sciences.

For more information on the Department of Biological Sciences at Carnegie Mellon University with up-to-date news and events, visit us online.

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