DEPARTMENT OF

BIOLOGY

SCHOOL OF ARTS & SCIENCES
UNIVERSITY of ROCHESTER

Naked Mole Rat

Awarded "Vertebrate of the Year"
by *Science* magazine

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MESSAGE FROM THE CHAIR

Dear Students, Families, Alumni, Friends, and Colleagues,

Congratulations, Class of 2014, you've done it! Your graduation today marks both a personal milestone for you and our official acknowledgement of the years of hard work you have put into your academic pursuits. Your graduation marks a transition—but a major one—in what we hope will be a lifelong journey of learning, creation, discovery, and reflection. We also want to acknowledge and offer our deepest thanks to the parents and others who have supported, in so many ways, today's graduating seniors.

This year, we have 222 students graduating with degrees in areas covered by the Undergraduate Program in Biology and Medicine (UPBM), including the BA in biology and BS degrees in molecular genetics, cellular and developmental biology, ecology and evolutionary biology, microbiology, neuroscience, and biochemistry. Twenty percent of this year's UPBM graduates will be receiving diplomas for double majors or degrees. There are an additional 28 UPMB students who entered Rochester in the Class of 2014, but who have been accepted into the University's Take Five and Kauffman Entrepreneurial Year (KEY) programs.

Remarkably, 50 percent of this year's graduating UPBM majors have carried out independent research. This high percentage illustrates the commitment of both students and faculty to research and the importance of this discipline to understanding current biology. As a department, we are particularly gratified that we can offer our students the opportunity to conduct research firsthand in world-class laboratories. It is not only a wonderful experience for our undergraduates but also for our graduate students, who often mentor their junior colleagues, and for the faculty members. Working one-on-one with undergraduates is one of the most satisfying experiences in academia.

The department has had an exceptionally good run in hiring outstanding new faculty members in the last couple of years. Sina Ghaemmaghami joined the department in July 2012, Jenn Brisson in July of 2013, and Dragony Fu in January 2014. Sina's research concerns the development and deployment of methods to assess the dynamics of protein synthesis and folding. Because several neurodegenerative diseases result from alternative folding patterns of proteins, this research can be relevant. Sina was recently honored with a prestigious and highly competitive five-year NSF Early Career Award. Jenn's lab is interested in various aspects of development and evolution of morphological variation, using pea aphids as a model system. In these insects, the development of winged vs. wingless individuals can depend either on genetic variation among individuals or on the environments (such as levels of crowding) they experience. Dragony's lab uses biochemical, molecular biological, and cellular methods to investigate how cells respond to various stresses, such as agents that can cause DNA damage. This research can lead to a deeper understanding of the underlying cellular basis for cancer and degenerative diseases associated with aging. With respect to teaching, Jenn will be taking over BIO 190 (Genetics and the Human Genome) from Tom Eickbush, and Sina and Dragony will be teaching two different sections of BIO 250 (Biochemistry).

Two more individuals will be joining us in the coming months. Christian Rabeling will move from his position as a junior fellow at Harvard to join us in July, and Amanda Larracuente, currently a postdoc in our department, will join our faculty next January. Christian works on tropical ants, studying a variety of incredibly interesting aspects of their natural history, including asexual reproduction and social parasitism of one ant species by a closely related species. Amanda's research focuses on selfish DNA, intragenomic conflict, and genome evolution in *Drosophila*.

Among the exciting happenings in the department this past year has been the naming of the naked mole rat as the "Vertebrate of the Year" by *Science* magazine, an award based to a large extent on several remarkable discoveries published by Vera Gorbunova and Andrei Seluanov and their groups this past year. For research into the mechanisms of aging, Vera was selected to receive the Longevity Research Award in 2013, awarded by the ADPS (Associations de Prévoyance Santé). Vera and Andrei together were awarded the 2014 Prince Hitachi Prize in Comparative Oncology for their research clarifying the molecular mechanisms of cancer resistance of the naked mole rat.

On another front, the College has undertaken a major initiative in data science—the development and use of methods to extract meaningful patterns from massive data sets, which are increasingly available in multiple disciplines, including biology. The first faculty searches for data science were undertaken this year, with biology fully involved in the process.

This is the inaugural issue of the online version of the *Open Reading Frame*. I would like to extend a special thanks to Brenna Rybak for spearheading this transition and getting this up and running. I hope that you will peruse the entire issue, as there are many interesting goings on reported here. And I urge you to follow the department in future issues of the ORF as well as on our department web page. Please let us know what is going on in your lives, as we'd love to hear from you and pass on your news to friends, classmates, and fellow alumni.

John Jaenike

Professor of the Year in Natural Sciences

Cheeptip Benyajati

On April 18, the University of Rochester's Students' Association named Cheeptip Benyajati, director of the Undergraduate Program in Biology and Medicine and Associate Professor of biology, Professor of the Year in Natural Sciences.

The Students' Association Professor of the Year Award was created in 1981 to increase awareness of the importance of undergraduate instruction. The program recognizes faculty members for their achievement purely as an undergraduate professor. The award is given annually to recognize a professor in each academic division of the College (engineering, humanities, natural sciences, and social sciences) who makes a positive and lasting impact on undergraduate student life at the University through dedication to developing relationships with students and creation of an engaging and challenging classroom atmosphere, as well as inspiring the further pursuit of knowledge.

Students were impressed with Benyajati's enthusiasm for biology and her unique style of teaching. They also expressed how supported they felt by her mentorship outside the classroom. It is clear that her students have a profound respect and appreciation for her knowledge and dedication.

Congratulations, Associate Professor Benyajati!

The Undergraduate Program in Biology and Medicine (UPBM): The Bigger Picture

The Undergraduate Program in Biology and Medicine, also known as "The UPBM," combines the School of Arts & Sciences and the School of Medicine and Dentistry to provide courses for undergraduate students with lectures, laboratory work, specialty seminars, and research experiences.

The program provides academic year opportunities to do independent research for credit as well as de Kiewiet Summer Fellowships, which support summer research by outstanding University of Rochester undergraduate students. The UPBM is made possible by the close proximity of the Medical Center to River Campus and the enthusiasm of the faculty for cooperative teaching aimed at providing the most up-to-date education in biomedical science.

Founded by Robert Marquis in the early 1980s, the program has been turned into an accredited institution and serves as a major conduit for undergraduate students into research labs at the medical school. The success of the program has been tremendous, as over half of this year's senior UPBM majors have engaged in research experiences thanks to Marquis's vision. Sadly, Marquis passed away recently. For more information on Marquis and his accomplishments, visit **www.urmc.rochester.edu/news/story/index.cfm?id=4014.**

The Department of Biology together with the Departments of Biochemistry, Microbiology, and Neuroscience produce the framework of The UPBM. All together in the Class of 2014 there are approximately 222 UPBM majors participating in the University's graduation ceremony this year (120 women and 102 men). The 2014 Biology Diploma Ceremony is being held on Sunday, May 18, 2014, at 11 a.m. in the Palestra at the Goergen Athletic Center. This biology department ceremony includes the following majors: BA in biology, BS in cell and developmental biology, BS in ecology and evolutionary biology, and BS in molecular genetics. Approximately 113 seniors are eligible to walk in the Biology Diploma Ceremony. Ceremonies for the biochemistry, microbiology, and neuroscience majors are celebrated separately.

For more information on this year's graduates, including distinctions earned, Independent Research participants, de Kiewiet fellows, awards, accomplishments, certificates, and academic honors, visit www.rochester.edu/College/BIO/UPBM/UPBM_Enewsletter/ 2013-14/04_June14.pdf.

Graduating Student Profiles

Ben Goulet '14 (Ecology and Evolutionary Biology)

The most formative experience of my time as a biology undergraduate has been working on an independent research project in Professor Presgraves' lab, where I studied genetic factors that contribute to speciation in fruit flies. In addition to conducting experiments, it has been through close contact with Presgraves and fellow lab members that I have learned firsthand how academic science is done. Most importantly, I have learned how to be appropriately skeptical and how to follow up that skepticism with critical thinking. This sort of critical thinking is imperative in science, but it takes confidence to be skeptical. For me, the essential step in gaining this confidence was appreciating that scientific knowledge is not static—that models evolve in response to new data.

My advice to any undergraduate is to be deliberate about how you choose to spend your time outside of class. College is a chance to focus on thinking, and there is no reason to limit that thinking to coursework alone. Pursue your interests outside of class with equal intensity—think about them, wonder about them. I spend a lot of free time thinking about hip-hop, clothes, and photography, and, thanks to the flexibility of Rochester's curriculum, I was able to engage my passion for photography with a minor in studio art.

I plan on continuing my biology education in graduate school, and I will take with me a confident passion for academic rigor I first experienced in this department.

Sarah Joseph '14 (Molecular Genetics)

The most important thing I learned from studying biology here is that collaboration is extremely important. This includes collaboration in the classroom and in research. Studying should never be conducted alone! It is important to receive new ideas or new ways of thinking to really understand a topic. Furthermore, collaboration in research is crucial for gaining the big picture idea of your project.

I want to be a professor (eventually), so this school definitely prepared me for the research and teaching aspect of the position. I have been a teaching assistant seven times in my career and I have been in a lab for three years. In addition, there are many seminars held by the biology department that are informative and interesting for stimulating new research topics for the future.

My advice is to get started in research EARLY (perhaps even experience many different types of labs) so you can have an idea whether you want to have a career in the field, at the bench, in a dry lab, etc. It is important to make an educated decision about research before you begin in a lab. When you want to get started in a lab, read about three papers that were released in the lab recently and email the professor to ask questions about the research being conducted. That meeting is the time to "pop the question" about working in that lab.

In my spare time, I have been president of Quiz Bowl, vice president of finance for Jackson Court two years in a row, secretary of Quidditch, and business manager for Quiz Bowl and logistics for the computer interest floor. I am also a member of many clubs, and I volunteer in a lab. I attend many research seminars held here and I have traveled to Oxford on the RIG for an oncology symposium there, and have attended three poster sessions. Yay science!

Yanhan Ren '14 (Molecular Genetics)

One of the most important things I've learned by studying biology is that it is true that classical research methods can help you to achieve the final results—but looking at it from a different angle can help you gain new perspectives on recent scientific discoveries.

As a premedical student, biology has helped me to prepare for medical school applications. I am an international student from Nanjing, China, and applying for medical school can be very challenging. Studying biology enriched my understanding of the natural sciences and also prepared me for continuing my education.

A biology major can be hard to maintain because at first you will be sitting in a big lecture hall and it can be hard to interact with the professor on a one-to-one basis. On the other hand, the core major curriculum in junior and senior years are much smaller and more interactive. You will be discussing hot scientific discoveries with the top scientific researchers on a daily basis. Therefore, don't give up too easily on a biology major; you will find many biology classes to be very interesting.

In my spare time, I was able to conduct independent research with the biology department and Medical Center professors. I also participated in National Research Conferences—2014 National Conference on Undergraduate Research (NCUR) at Kentucky University; 2014 National Collegiate Research Conference (NCRC) at Harvard University; 2013 Unite for Sight Global Health Conference at Yale University—and the College-wide Undergraduate Research Exposition.

I like swimming, kayaking, hiking, and playing badminton and table tennis. I also enjoy playing the piano, and I have served as Headmaster of the "Little Renal Friend" Volunteering Committee in Nanjing, China.

Katherine Strong '14 (Cell and Developmental Biology)

While studying biology over the past four years, one of the most important things that I have been taught is to question what I learn and to realize that there is always more that I can learn. My time as a biology student at the University of Rochester has helped me further develop an intrinsic curiosity to discover how biological topics relate to human life and the world around me.

Following graduation I will be pursuing a career in dentistry and will begin classes in the fall at the University at Buffalo School of Dental Medicine. While completing my cell and developmental biology major at Rochester, I was challenged to manage my time and maintain disciplined study habits. I am confident that my experiences in a diverse array of undergraduate biology courses have prepared me to succeed academically when I am faced with a rigorous course load in dental school.

My advice to students pursuing a biology major is don't be intimidated by the breadth of coursework that is required of a biology student. Select courses that interest you, ask questions when you need clarification of topics, and stay on top of your work. It is extremely rewarding to look back on your college education and know that you challenged yourself intellectually in a subject that you enjoy learning about.

While at the University of Rochester, I was an active member of Kappa Delta Sorority. I also spent my spare time volunteering at Rochester General Hospital, working as an intern at Mt. Hope Family Center, and shadowing in dental offices in the Rochester community.

MEET CHELSEA HANS

by Monique Patenaude

My work-study job is in the snail lab

On a recent Friday, the Society of Undergraduate Biology Students (SUBS) hosted a "mad scientist"-themed happy hour at Club Rochester.

"This is actually the third time in my four years here that we've done this event—it predates me," explains Chelsea Hans, a senior biology major from Buffalo, N.Y., who serves as SUBS president.

"We try to improve upon it every year we do it. Physics always has such cool displays, and I was like, 'bio really needs a cool display this year, so I'm gonna bring in some snails from the bio lab I work in.'" Along with posters, t-shirts, and petri dishes filled with Jell-o and gummy worms, Hans brought a tank of her favorite mollusks to happy hour.

"They are of the genus *Ilyanassa*—that's what we study in our lab, the Lambert developmental biology lab. Mostly what I study is dorsal-ventral patterning in these snails. Basically, we are trying to figure out how some cells know how to become the back of the animal and the others become the front. They are really great models for that—and they're really cute," Hans says.

Hans thinks snails are getting the short end of the stick in terms of the role they play in laboratory studies. "It's kind of weird, because everyone hears about *Drosophila* (fruit flies), mice, and yeast as the big model organisms, but for snails, it's weird," she says. "Most people don't hear about them."

SUBS and stem cell awareness

The SUBS is one of the most active clubs on campus, she says. "We have close to 400 people on our mailing list, but in terms of active membership . . . probably like 30 to 40 people are regulars that come to multiple events per semester," says Hans, who, as president, oversees the club's activities. "We usually average 30–40 events each year. We organize lunches with professors—three to four general interest meetings every semester—we have study breaks during finals, and we do five different stem cell research awareness events in the spring.

Many SUBS events focus on getting students and faculty together. "We plan a lot small group events each year—like the lunches—we usually have eight or nine people, students and two professors," Hans says. "The lunches keep our membership involved and they create a lot of opportunity for our undergraduates to connect with professors. That's the biggest part of our mission statement."

"The big thing we do is STEM Cell Awareness Week," says Hans, who puts in up to 20 hours a week gearing up for the event. "It's the bulk of where our energy goes. That was this past week—we kicked it off with the Happy Hour. We also had a panel discussion, a silent auction, and a faculty-versus-student volleyball match." The faculty team won this year.

"Parents are encouraging their children to study what they love. And if that's math and science, then they should go for it regardless of their gender or ethnicity. At the campus level, there is a push for diversity. But it doesn't necessarily have to be directed at STEM fields anymore, because it's just the same as any other field these days."

STEM diversity

Hans doesn't think the media hype about a lack of women and minorities in STEM majors is well founded—at least not anymore. "I see a lot of diversity in STEM fields at the undergraduate level. Maybe not as much as there should be, but I really see that there is shift already happening," says Hans.

"There is not that stereotype anymore that, you know, women are supposed to be nurses and teachers. And there's not the stereotype that minorities don't go to college. Those stereotypes are going away, especially at institutions like this one," she points out. "Parents are encouraging their children to study what they love. And if that's math and science, then they should go for it regardless of their gender or ethnicity. At the campus level, there is a push for diversity. But it doesn't necessarily have to be directed at STEM fields anymore, because it's just the same as any other field these days."

Working in a lab

Hans explains that students should look for opportunities to be a lab assistant or researcher. "There are a lot of different ways you can go about working in a lab. Since I have work-study, I choose to do that for pay rather than as an internship. "You can work in a lab as an independent study type of thing, too, but with the amount of things I have going on, I just don't have time to write the final paper at the end of every semester. I've been with the lab for two-and-a-half years—that would be five additional papers," Hans says, widening her eyes. "But, hopefully we will have a paper published at the end of my studies."

Juggling

In addition, Hans joined the University of Rochester juggling squad, Strong Jugglers, in her freshman year. "It's all my boyfriend's fault," she says. "He joined the club and I went just once because he was my boyfriend—and I think I was trying to impress him," she confesses. "I wound up just loving it. I still juggle and am still with the boyfriend! I also play percussion in the University pep band.

Hans's plans for after graduation? "I just accepted an offer to get my PhD in cell and developmental biology at Penn State," she announces. "It's very exciting!"

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New Faculty

JENNIFER BRISSON

By John Jaenike, PhD

Jennifer is particularly interested in the molecular genetic basis of phenotypic plasticity, the process by which genetically similar—or identical—individuals can develop into very different looking creatures. The organism of choice in her lab is the pea aphid.

Jenn Brisson joined the department last July as an assistant professor, having moved here from the University of Nebraska. Jenn's research focuses on how genes and environment interact to affect an organism's morphology. She is particularly interested in the molecular genetic basis of phenotypic plasticity, the process by which genetically similar—or identical—individuals can develop into very different looking creatures. The organism of choice in her lab is the pea aphid. Aphids exhibit several remarkable types of phenotypic plasticity, switching from sexual to asexual reproduction, from winged to wingless morphs, and from one host plant species to something very different. Their capacity for rapid sexual reproduction, by which innumerable genetically identical individuals can be generated, makes them ideal subjects for the study of phenotypic plasticity.

The path to studying morphological evolution and phenotypic plasticity in aphids began long ago for Jenn, as she has had a nearly lifelong interest in biology. What got her going was a particularly influential teacher (Mrs. Huse), who was Jenn's teacher in first and fifth grades and science teacher in sixth through eighth grades. Jenn got seriously into research as an undergraduate at Kansas State University, where in Rob Denell's lab, she studied flour beetles from the perspective of the newly emerging field of "evo-devo" (evolutionary developmental biology). Having gotten hooked on evo-devo, she continued in this area in graduate school at Washington University in St. Louis, where she was co-advised by Alan Templeton, a population geneticist, and Ian Duncan, a *Drosophila* developmental biologist. Her dissertation focused on the evolutionary and developmental basis of variation in pigmentation patterns among species of the *Drosophila* cardini group, whose members differ dramatically from one another. As a side project, Jenn also did field work on the population ecology of collared lizards in the Ozarks during her years as a graduate student.

During the course of her graduate studies work, Jenn became interested in how similar patterns of morphological variation could be under genetic control in one species or sex but phenotypically plastic in another. This led to her doing postdoctoral stints at Princeton with David Stern and then at UC–Davis with Sergey Nuzhdin, where her research turned to pea aphids. Aphids are an emerging

model system for the study of such plasticity. For instance, winglessness is under genetic control in male pea aphids but environmental control in females, meaning that only females exhibit phenotypic plasticity for wing morphology in this species.

Jenn has an active lab, currently running with three PhD students. Swapna Purandare, who will be defending her dissertation this spring back in Nebraska, has studied how different morphs of aphids differ in the expression of a chemoreceptor gene. Mary Chaffee, who transferred from Nebraska to Rochester, is interested in the role of epigenetic mechanisms in the development of different aphid morphs. Binshuang Li joined the lab soon after Jenn arrived in Rochester, and he is investigating the genetic basis for wing polymorphism in male aphids. In addition to these graduate students, Jenn's lab is home to Samantha Colayori, a research technician whose master's degree research focused on infrared vision of pit vipers. (Be careful: they can see you when it's pitch black outside.) Adam Smith is an undergraduate majoring in biochemistry, who is getting started on epigenetic research. Finally, Tannice Hall is a visiting scientist from University of West Indies in Jamaica. Tannice is learning insect physiology methods, which she will take back to her home institution.

Jenn taught a graduate seminar on phenotypic plasticity in the fall of 2013, and she is going to be taking over BIO 190 (Genetics and the Human Genome), a course that had been developed by Tom Eickbush. With Jenn's broad range of interests, encompassing genomics, phenotypic plasticity, development, and evolution, it should be a fascinating course.

Jenn is married to fellow biologist Ryan Bickel, whom she met when she was a postdoc at Princeton. Ryan's research has focused on the genetic basis of variation in abdominal pigmentation in Drosophila, as well as on aspects of phenotypic plasticity of aphid development. Despite the brutal winter we just went through, Jenn and Ryan have enjoyed living in Rochester. Ryan's family lives in the area, which gives him and Jenn opportunities for family dinners, birthday parties, and so on. Jenn and Ryan live near Cobbs Hill, where they enjoy hiking and walking their dog.

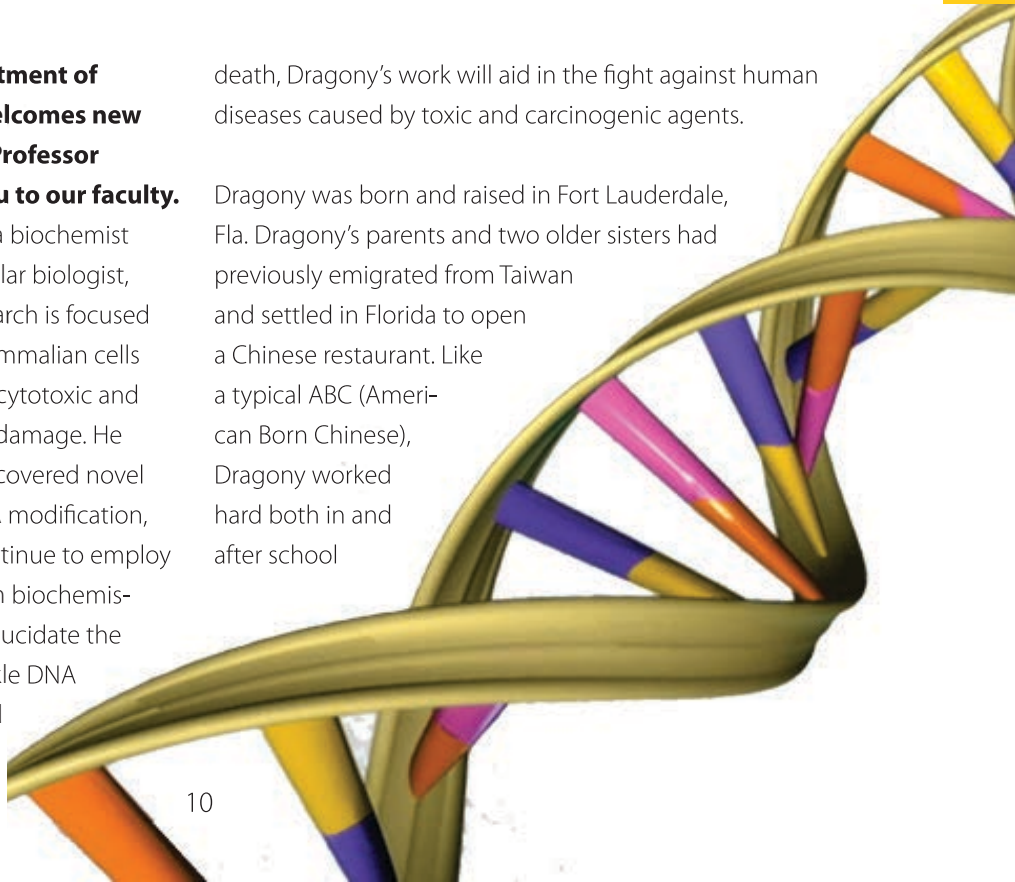
Jenn says that being a scientist is hard work, but that there are times of joy and discovery that make the effort most worthwhile. There are doubtless many interesting discoveries to be made in the Brisson lab in the years to come.

DRAGONY FU

By Xin Bi, PhD

The Department of Biology welcomes new Assistant Professor Dragony Fu to our faculty. Dragony is a biochemist and molecular biologist, whose research is focused on how mammalian cells respond to cytotoxic and mutagenic damage. He recently discovered novel cellular factors promoting DNA repair, RNA modification, and programmed cell necrosis. He will continue to employ a combination of cutting-edge methods in biochemistry and molecular and cell physiology to elucidate the molecular mechanisms by which cells tackle DNA damage. Given that DNA damage can lead to mutations, genome instability, and cell death, Dragony's work will aid in the fight against human diseases caused by toxic and carcinogenic agents.

Dragony was born and raised in Fort Lauderdale, Fla. Dragony's parents and two older sisters had previously emigrated from Taiwan and settled in Florida to open a Chinese restaurant. Like a typical ABC (American Born Chinese), Dragony worked hard both in and after school



while he was growing up. He still has vivid memories of himself doing homework in the back of his family's restaurant, helping to chop vegetables, and even running the cash register when business was hectic!

During his doctoral qualifying exam, Dragony calculated that he needed $5x10^{20}$ liters of human cells to purify human telomerase, a volume greater than the Atlantic Ocean. Fortunately for Dragony, his calculation was a gross overestimate and he succeeded in purifying human telomerase complexes, a hallmark achievement in the field. This significant work revealed novel factors involved in telomerase assembly and function, thereby providing new insight into the regulation of human telomerase activity.

Dragony's family frequently explored the natural wildlife habitats of Florida, which provided the initial spark for Dragony's interests in biology. When he was about to graduate from high school, Dragony was torn between the desire to go to a top university far away from home or enrolling in a local college. Fortunately, his sister Kathy encouraged him to venture into the outside world beyond beaches and alligators and enroll at the University of Chicago.

Dragony started as an economics major at Chicago but classes in molecular genetics and biochemistry made him realize that he was much more fascinated by macromolecules rather than macroeconomics. To experience what biological research was all about, he joined the lab of cell biologist Benjamin Glick to analyze genes involved in the cellular transport of organelles in the yeast *Pichia pastoris*. Dragony's first research experience included contaminating all the lab's agar plates and attempting to load and run an agarose gel made with undiluted 50X buffer. Fortunately, he persevered through his initial difficulties and discovered that the *ACT1* gene from *Pichia* contains two introns, which represented a significant step in the characterization of intron structure in *Pichia*.

Following his graduation from the University of Chicago, Dragony traveled east to start a one-year postbaccalaureate fellowship in Carl Wu's lab at the National Cancer Institute in Bethesda, Md. The Wu lab is one of the leading research groups in chromatin structure and function, which provided Dragony with essential knowledge of molecular biology and biochemistry techniques. Moreover, Dragony contributed to the reconstitution of chromatin modeling factors and their interactions with transcription factors. Conveniently, Dragony's sister Kathy was doing a clinical fellowship in hematology at the nearby National Institutes of Health and was kind enough to let him crash on her living room couch—for the entire year!

Afterwards, Dragony started graduate school in the Department of Molecular and Cell Biology at the University of California–Berkeley. He joined Kathy Collins's lab to study the biogenesis of human telomerase, the crucial enzyme necessary for maintaining our chromosome ends. During his doctoral qualifying exam, Dragony calculated that he needed $5x10^{20}$ liters of human cells to purify human telomerase, a volume greater than the Atlantic Ocean. Fortunately for Dragony, his calculation was a gross overestimate and he succeeded in purifying human telomerase complexes, a hallmark achievement in the field. This significant work revealed novel factors involved in telomerase assembly and function, thereby providing new insight into the regulation of human telomerase activity.

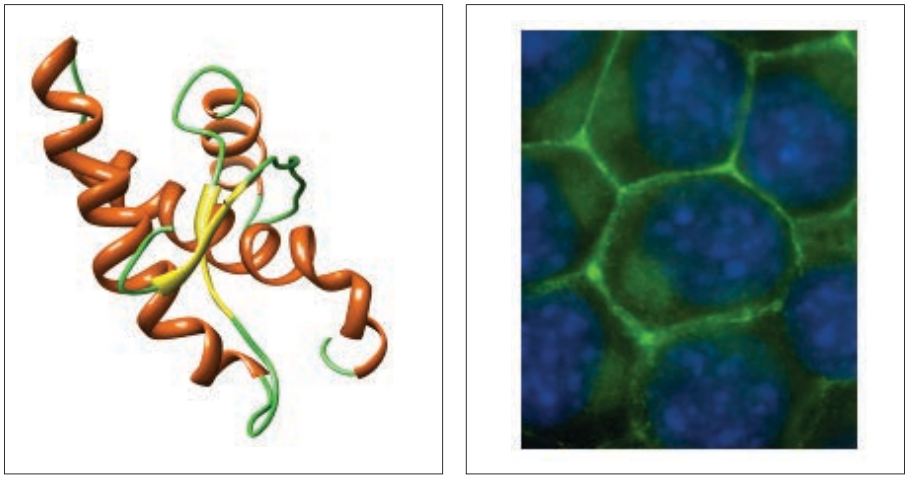
After finishing his PhD studies at UC–Berkeley, Dragony joined Leona Samson's lab at MIT to study the cellular response to DNA damage. His postdoctoral work focused on the ALKBH family of human proteins, which are homologs to the bacterial AlkB enzyme. AlkB had just been shown to directly repair DNA damage through oxidative demethylation, which represented an entirely novel form of DNA repair. Dragony and others found, to their pleasant surprise, that the nine human AlkB homologs play diverse functions in multiple cellular processes. He demonstrated that ALKBH2 repairs a novel DNA lesion, ALKBH8 is a tRNA methyltransferase, and that ALKBH7 is required for regulated necrosis, an emerging form of programmed cell death. He plans to continue digging in the gold mine of ALKBH proteins and hopes to become THE authority of this emerging field in the not-so-distant future.

Since Dragony's arrival in Rochester in January, he has been busy doing shopping sprees for lab equipment, recruiting lab personnel, and decorating his office. Outside of the lab, Dragony loves to eat, bake, and run. He has promised to host a lab-warming party and bake treats for the whole department when he settles down.

SINA GHAEMMAGHAMI

By Xin Bi, PhD

Sina Ghaemmaghami joined the biology department in July 2012 as an assistant professor. Sina's research focuses on the mechanisms governing protein homeostasis in cells including protein expression, folding, and degradation. An imbalance between these processes for certain proteins such as prions can result in diseases in mammals. The prion diseases are a series of neurodegenerative disorders exemplified by the human Creutzfeldt-Jakob disease and bovine spongiform encephalopathy better known as the mad cow disease. Sina is using state-of-the-art technologies in biochemistry and cell, systems, and computational biology to investigate the propagation and pathogenesis of prion proteins. Moreover, he is developing novel methodologies for system-wide analysis of protein expression and turnover. Sina is recognized as one of the most promising researchers in the field of protein folding. He has established a well-staffed, vibrant research program since joining the biology department. Sina recently received a prestigious National Science Foundation (NSF) Faculty Early Career Development Award (CAREER), which will not only help fund his research but also allow him to significantly contribute to the integration of undergraduate education and research at the University.



In prion diseases, such as Creutzfeldt Jakob Disease (CJD), the prion protein (left) aggregates, resulting in death on neurons. Shown to the right are neuronal cells with the prion protein (green) localized mostly to the outer cell membrane. Our laboratory is trying to understand why the prion protein aggregates and why this aggregation causes neurons to die.

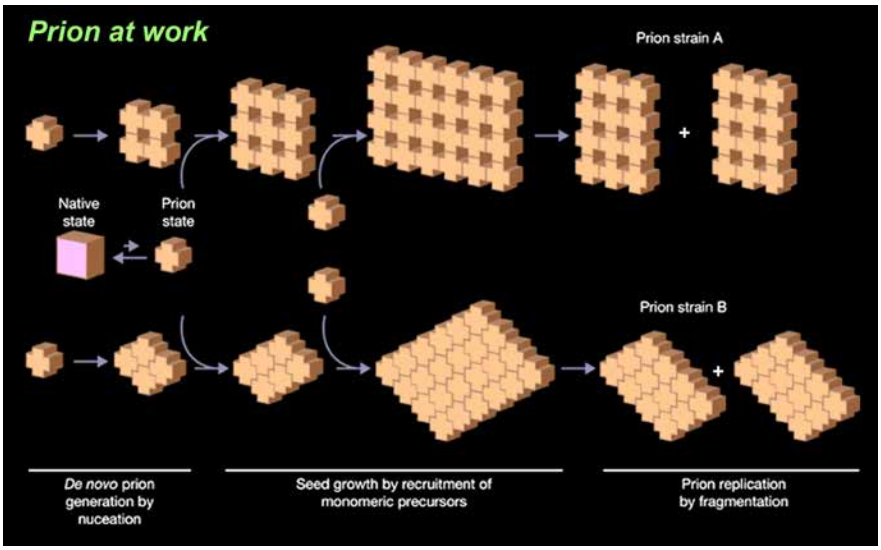
Born to an Iranian immigrant family in Lexington, Ky., Sina spent his childhood in Iran, and came back to the states to attend junior high school in Ohio. He then moved with his family to Toronto, Canada, where he completed high school. Sina developed a keen interest in physics and chemistry and was also fascinated by computers. He learned computer languages and became good at writing computer code in high school, which later greatly benefited his scientific career.

After graduating from high school, Sina enrolled in McMaster University in Hamilton, Canada, in 1991, majoring in biochemistry and minoring in physics. In his sophomore year, Sina did undergraduate research on thermodynamics and kinetics associated with protein folding. Sina loved this area of research and continued to work in it during the rest of his college time. In his senior year, he got a chance to intern at the pharmaceutical firm Boehringer Ingelheim in Montreal for eight months. There he was trained in molecular biology and protein expression techniques. Although he liked the professional environment of the industrial setting, Sina realized what he would really enjoy were the freedom, challenges, and excitement associated with academic research. Following his graduation from McMaster, Sina joined the graduate program in the Department of Biochemistry at Duke University in 1996.

Sina did his PhD studies with Terrence Oas, an expert in the protein folding field. He took on a challenging project aimed at developing new methodologies for studying protein stability that could overcome the limitations of conventional methods. Sina succeeded in establishing novel hydrogen-exchange based technologies for monitor-

ing protein thermodynamics. His methods made protein folding amenable to quantitative and high throughput analyses. Moreover, they could also be used to study protein stability and protein-protein interactions in living cells. Sina is very proud of this significant achievement, which was documented in his 260-page PhD thesis and several publications in top journals. Sina really appreciated the advice and help he received from his strong thesis advisory committee that included legendary biophysicist Jane Richardson and biochemist Gordon Hammes.

Having obtained excellent training in protein folding from Duke, Sina joined Jonathan Weissman's lab at the University of California–San Francisco as a postdoctoral fellow in 2001. He originally hoped to study prions but instead followed Weissman's suggestion to work on functional genomics and proteomics in the budding yeast. Sina led a team of colleagues to achieve the daunting task of creating a fusion library in which each yeast open reading frame is fused to an epitope tag and expressed from its natural chromosomal location. This enabled Sina to pioneer in studying global protein expression in yeast. This landmark work was published in *Nature* and cited thousands of times in the literature. Moreover, Sina also played key roles in other high-impact studies on ribosome profiling and gene expression noise. His achievement in the Weissman lab has established him as a leading expert in the fields of functional genomics and proteomics.



Sina's hope to work on prions was eventually realized in 2006 when he took the position of assistant adjunct professor at the Institute for Neurodegenerative Diseases at UCSF. His advisor was none other than Stanley Prusiner, winner of the 1997 Nobel Prize in Physiology or Medicine for his discovery of prions as a new biological principle of infection. Sina was engaged in two important projects. One was high-throughput screen for small molecules that inhibits prion formation, and the other was examination of the replication of prion strains. Sina found several anti-prion molecules that could potentially serve as the basis of developing therapies for prion diseases. He also elucidated mechanisms regarding prion propagation through cell division and the adaptation of prion population to its host environment. These studies provided a strong foundation for Sina's current research here in the biology department.

One disadvantage of having Prusiner as an advisor was that Sina rarely saw him. Every time Sina wanted to meet with Prusiner, he had to make an appointment through Prusiner's assistant/secretary Brenda Klein. After a certain number of appointments, Sina started dating Brenda, and their relationship thrived as did Sina's research in the Prusiner lab. When Sina left Prusiner's lab for the University of Rochester, he brought with him not only exciting research projects but also his girlfriend Brenda, who was to become administrator of the Department of Biochemistry and Biophysics at the University of Rochester Medical Center.

Sina and Brenda now live in the beautiful Highland Park area. They enjoy biking, visiting historic sites, and wine tasting, and have recently started to learn sailing. Brenda enjoys cooking. In fact, she used to work as a pastry chef at the renowned French Laundry Restaurant in the Napa Valley in California before moving to San Francisco to work for Stanley Prusiner. Luckily for Sina, Brenda does most of the cooking at home.

(RoAR)

University Establishes Rochester Aging Research Institute

This year, the University of Rochester founded the Rochester Aging Research Institute (RoAR). RoAR is a rare collaborative venture by both the College and the Medical Center Administrations. Goals for the institute are to understand basic mechanisms that determine longevity and develop strategies to extend lifespan and health span by slowing down the aging process. The program will capitalize on existing strengths in research on the mechanisms of aging and gerontology in several model systems, including yeast, worms, flies, long-lived mammals such as naked mole rat, and humans. RoAR, led by Vera Gorbunova (biology) and Dirk Bohmann (biomedical genetics), will fund pilot projects, student travel, and local conferences.

Faculty Press Releases

Biologist Vera Gorbunova to Lead Five-Year Project on Longevity

www.rochester.edu/newscenter/biologist-vera-gorbunova-to-lead-5-year-project-on-longevity/

Biologist Sina Ghaemmaghami Honored with a National Science Foundation Early Career Award

www.rochester.edu/news/show.php?id=8052

Naked Mole Rat Named Vertebrate of the Year

www.rochester.edu/news/show.php?id=7992

A Homely Rodent May Hold Cancer-Fighting Clues

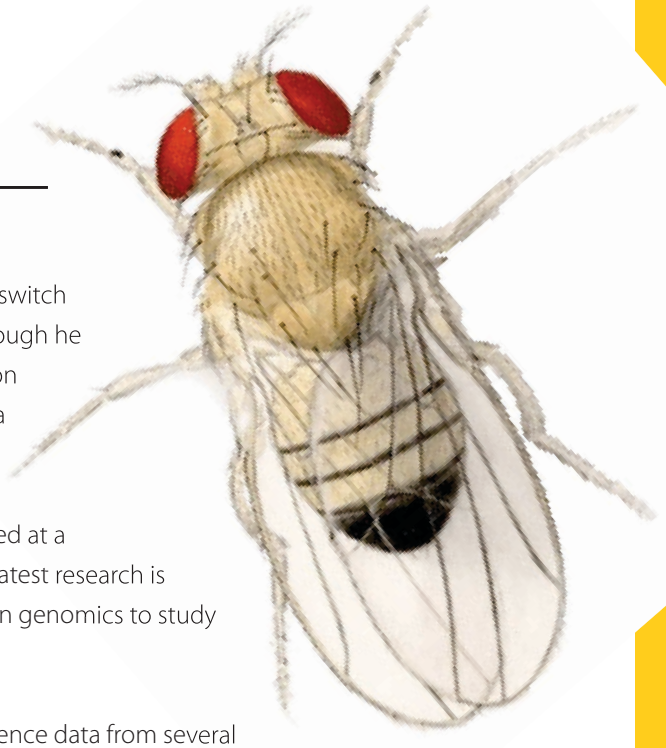
www.nytimes.com/2013/06/19/science/a-homely-rodent-may-hold-cancer-fighting-clues.html?_r=4&

Research Suggests Madagascar No Longer an Evolutionary Hotspot

www.rochester.edu/news/show.php?id=6672

Cool Science—Spotlight on
DANIEL GARRIGAN, PHD

By H. Allen Orr, PhD



Dan Garrigan has always been willing to switch fields and to pursue new problems. Although he began his career by studying conservation genetics as a graduate student at Arizona State University, he shifted early on to human population genetics. And as Rochester's biology department learned at a recent seminar, he's done it again. Dan's latest research is focused on using comparative population genomics to study speciation in the fruit fly *Drosophila*.

Comparative population genomics involves using whole genome sequence data from several species to draw conclusions about how evolution works. Dan is using whole genome data to ask questions about how new species arise. His shift to speciation studies and to *Drosophila* as a model system partly reflects the expertise of his colleagues at Rochester, especially Daven Presgraves with whom he collaborates, and partly reflects the dramatic increase in the amount of genome sequence data available in fruit flies. As Dan concludes, "I go where the data are better."

Although evolutionists know much more about how new species arise than they did two decades ago, research has revealed some real surprises. One is that species may split from each other while still exchanging some migrants. One consequence of this so-called speciation with gene flow or "complex speciation" is that some regions of the genome might diverge between two species faster than other regions. If some regions of the genome carry incompatibility alleles (that cause, say, hybrid sterility between the two incipient species), these regions can't pass readily between two species; other genomic regions that don't carry incompatibility alleles can, however, pass readily between the two species. Consequently, the former regions might look fairly different between species and the latter regions might not.

Dan's lab is using genome data from several closely related species—*Drosophila simulans, D. mauritiana,* and *D. sechellia*—to study this process. *D. simulans* is a widespread mainland species while *D. mauritiana* and *D. sechellia* are restricted to different islands in the Indian Ocean. Their key findings are simple: although these species split from each other over 200,000 years ago, some regions of the genome show signs of quite recent gene flow between the mainland and island species. Better yet, this gene flow shows a striking pattern: regions of the genome that sit on the X chromosome show little evidence of such recent gene flow while regions that sit on the autosomes often do. These findings, which Dan and colleagues published in 2012 in the journal *Genome Research,* agree nicely with classical genetic studies of speciation that were performed over the last 20 years. Those more functional studies revealed that the genes that cause incompatibilities between species (like hybrid sterility) are concentrated on the X chromosome, the so-called large X effect of speciation. Dan and colleagues appear to be seeing the genomic signature of these X-linked incompatibilities at the level of whole genome DNA sequences.

In more recent work, Dan and his colleagues have sequenced the entire genomes of multiple strains of *D. simulans* and *D. mauritiana*. This means that they not only have information about between-species differences but within-species genetic variation. Analysis of these data demands considerable computational expertise; genomes are large and comparative

genomics sits squarely in the world of big data. Analysis has also demanded the creation of new statistics to help make sense of these vast reams of data. In particular, Dan has created a simple new measure of gene flow between species; the smaller this statistic for a region of the genome, the more recently gene flow occurred between species in this region.

As Dan and his colleagues analyze these new genome data, they are uncovering yet more surprises. In particular, they are finding further evidence that the X chromosome evolves differently from the autosomes and in several ways. They find, for example, that X-linked sequences often evolve between species faster than do autosomal sequences. Similarly, X-linked sequences have an unusual sequence composition. Finally, X-linked sequences have experienced much more "hitchhiking"— recent sweeps of beneficial mutations through a species. Such sweeps wipe out genetic variation at DNA sites that sit close to the beneficial mutation.

In future work, Dan hopes to make more sense of why it is that certain regions of the genome evolve so quickly, and also why certain regions move and sweep across species boundaries while other regions do not. Do the latter regions, for instance, contain specific genes known to cause hybrid sterility?

Given the many evolutionary biologists at Rochester who are interested in speciation, Dan might well be ideally situated to answer this question.

Alumni Profile

JEANNINE RIDER

Name: Jeannine Rider
Occupation: Patient Care Technician
Majors: Biology and Psychology
Community Activities: Volunteer at Ronald McDonald House of Charities; AP Biology Tutor

Why did you choose to attend the University of Rochester?

I chose the University of Rochester, because I was impressed by its flexible curriculum and its architecture. I loved how the cluster system required students to be well-rounded and focused on their own interests. I also loved how the vine-entangled, red brick, and white-columned buildings provided a picturesque setting for cultivating curiosity.

How did you choose your major?

My interests led me in the direction of studying the human as an individual—body, mind, and soul. I double majored in biology and psychology with a cluster in religion. In the back of my mind, I knew I was interested in pursuing medicine, but I wanted to keep my options open.

What did you do immediately after graduation? How did you decide to take that path?

After graduating, I was accepted into the Peace Corps and served for two and a half years in Namibia, southern Africa, as a math/science teacher. I lived in a rural village on a traditional homestead without electricity or running water, but I faced greater challenges living within a patriarchal, postapartheid society as a white American female.

I chose this path, because I wanted to apply the skills I had learned in school to serve both a developing country and my own country. I wanted to learn a new language, meet a diverse array of people, transform an unusual landscape into a familiar one, and immerse myself in an entirely different culture. I was able to do all that and more in Namibia.

What do you do now and why did you choose this career?

Since my Peace Corps experience, I have returned home and applied to medical school. I work in the emergency room of a local hospital as a Patient Care Technician, which has enlightened me to the social structure and interpersonal

dynamics of hospital life. I believe that all medical students should be required to do similar work for a certain number of hours, because it provides a broader perspective of the work of your counterparts and trains you how to truly care for sick people.

Thanks to the help of my professors and health professions advisors at Rochester, I will be attending Alpert Medical School of Brown University in August. I chose this career, because it combines all of my interests of learning about, assessing, and helping individuals feel better.

What advice do you have for current students?

Make your autobiography something you would love to read. You have the power to create your story. If you love your story, others will too, and your passion will shine.

Use your resources to explore your interests. Meet with your professors and catch the knowledge they're droppin'. Set up meetings with advisors and get some advice.

Self-reflect on the balcony of Rush Rhees, overlooking the quad like this world is your kingdom.

What is your opinion regarding graduate school vs. working right after graduation?

Go to school when you yearn to learn, not to get it over with. Experiential diversity enhances a grad school application too, and you will likely have more to offer as a student after having life experience.

Where would you like to be in five years?

On a boat with five more letters next to my name, namely: MD, MPH . . . headed back to Africa.

Enhanced Community Outreach

Tutoring Ms. Ortenzi's School 58 Honors Biology students at the Rochester City Library

Working and studying at the University of Rochester is an exceptional privilege that more often than not comes to those with strong elementary and high school education backgrounds. The biology department is expanding our education mission to various demographics of the greater Rochester community, with a special focus on communities where grade school performance is lagging. Though many department members have participated in outreach efforts over the years, a major departmental objective going forward is to integrate our efforts into a coordinated outreach mission that supports first-generation and/or low-income Rochester School District students beginning as early as elementary school with the goal of gaining admission into college. Other efforts are aimed at enriching educational opportunities for suburban schools and the lay public in general. Fund raising efforts to support some of the newer programs will begin in earnest over the next year. Potential supporters can contact the Biology Office for information. Below are descriptions of current outreach programs that serve both suburban and city communities.

Rochester City School Programs: We are instituting multiple programs at School 58 (K–12) to support and encourage first-generation and/or low-income students to set college admission as an achievable goal. This mission is made easier by preexisting outreach agreements between David T. Kearns Center at the University of Rochester and Rochester City High Schools. Our current focus is on enriching the educational experience of middle and high school students, including in-class presentations by biology faculty and graduate students, visits to the Rochester campus for lab demonstrations, and weekend tutoring of an honors eighth grade biology class.

Professors Jennifer Brisson and Sina Ghaemmaghami are co-organizing a two-week on-campus summer course for high school students in the Upward Bound program, an initiative of the David T. Kearns Center that supports Rochester City School District first-generation and/or low-income high school students in a year round effort to apply to and gain admission to college. The hands-on course will cover a range of topics in biology. Approximately seven biology faculty members and 10 graduate students will be involved in teaching the course. Plans are in the works to expand participation and course content in the coming years.

A new mentoring program, SURF-MP, that matches promising middle school students with biology department faculty, is entering a pilot phase. The intent is to establish and maintain student-mentor relationships throughout the student's middle and high school careers, and ultimately into college. Mentors will work with the students, their families and teachers to support each student's individual educational aspirations and challenges.

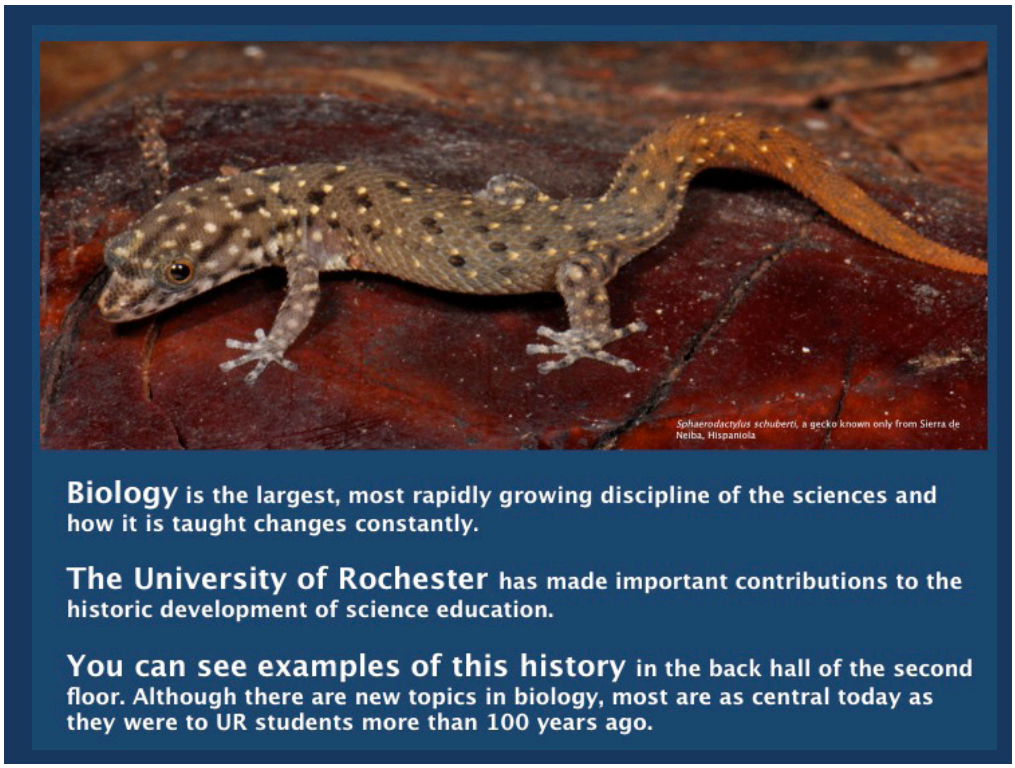
Biology Professors Elaine Sia (left), Sina Ghaemmaghami, and Jennifer Brisson are actively involved in department community outreach programs.

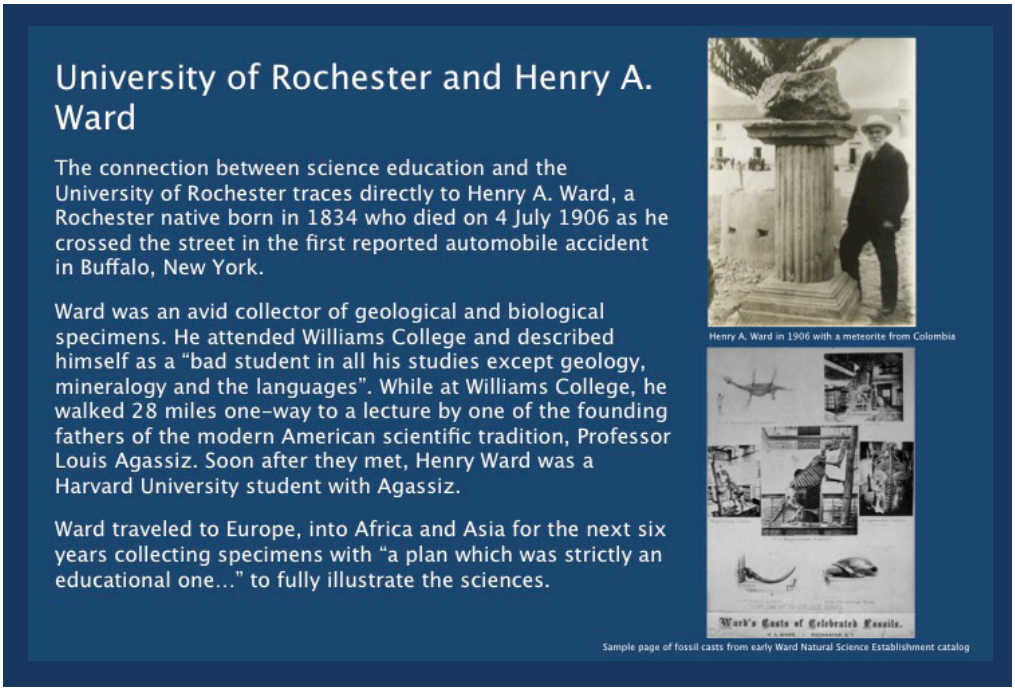
HF-L High School Computer Club: Computer programming skills are increasingly perceived as an asset for students interested in the sciences, humanities, and the arts. Many local suburban and city schools do not offer programming courses, possibly because many teachers lack expertise. Beginning with the 2013–2014 academic year the biology department has sponsored a pilot Computer Programming Club at Honeoye Falls-Lima High School. The HF-L Programming Club meets every Friday afternoon. Alex Wilson, a talented and committed University of Rochester computer science major, runs the club. The club offers a comfortable and informal venue for about 15 high school students who come to learn programming basics, new languages, apps, gaming, website construction and software development. The hope is the club will encourage the school to incorporate more programming opportunities into the formal curriculum.

Preserving Our History

Department of Biology Specimens and Archives

For further information about our specimens and their preservation or to find out how you can help, please contact our department administrator, Brenna Rybak, at (585) 275-8837.





To read last year's article about this project, please click here, www.rochester.edu/College/BIO/archives.pdf

Howard Bryant Memorial Golf Tournament

Howard Bryant Memorial Golf Tournament

June 2015

Special Newsletter Pre-Registration

If you think you might like to join us, please fill out the form below and we'll send you the registration brochure in January!

Check out photos from last year's tournament at:
http://www.rochester.edu/College/BIO/HB/hb2013show.mov

Prizes!

- Closest to Pin
- Longest Drive
- Raffles
- Doorprizes

Lunch & Dinner Provided!

Chili Country Club
760 Scottsville-Chili Road
Scottsville, NY 14546
www.chilicountryclub.com

Rather Donate Directly?

Direct Donations to the Howard Bryant Memorial Scholarship Fund are welcome and can be mailed to the address below.
If you wish to remain anonymous, please write "anonymous" on the memo line of your check.
Thank you for your support!

Checks should be made payable to the University of Rochester and mailed to:
Kathy Giardina
Box 270211
Rochester, NY 14627

Howard Bryant

Howard was a beloved member of the Biology Department at the University of Rochester for over 40 years.

All proceeds from this tournament benefit The Howard Bryant Memorial Scholarship Fund. The Fund was established in 2004 to honor Howard's legacy of caring and support by providing aid to students in need of financial assistance and who are interested in pursuing a career in Science or Engineering.

Pre-Registration Form

Name: _____

Address: _____

_____

_____

☐ **Yes, please send me more information about the Howard Bryant Memorial Golf Tournament!**

Golfers begin driving to their first hole assignment.

The team member with the best shot moves the team forward.

Sponsors are represented on the green.

Folks enjoy chicken wings and dinner while perusing all the raffle items.

A real live auctioneer starts the bidding on the best prizes!

To view the slideshow, please visit www.rochester.edu/College/BIO/HB/hb2013show.mov

(approximately 22 minutes).

Department of Biology

Fall Retreat

October 8, 2013

New York Wine & Culinary Center, Canandaigua, N.Y.

Adam Mason talks about C. elegans.

Dragony Fu, new assistant professor, enjoys the morning break.

The sun on the gorgeous woodwork made for a bright and cheery morning.

Purbha Gupta and Amanda Redding enjoy lunch.

Students played bocce ball and ring toss in the apple orchard.

David Goldfarb and Doug Portman have a friendly debate!

Everyone gathered for the grad student poster session with great wine and amazing hors d'oeuvres.

Sina Ghaemmaghami chats with our guest speakers, Adam Mason and Tim Anderson.

To view the slideshow, please visit www.rochester.edu/College/BIO/fallretreat/fallretreat2013.m4v
(approximately 14 minutes).

Meliora Weekend Biology Department

Open House

October 11, 2013

Have fun trying to identify your professors from old photos!

Come see what's going on in the department and browse our brochures, newsletters, and photo albums.

Biology specimens and archives are also on display.

The open house is a great way to make new connections.

Great food and drinks from Tasteful Connections Catering

Biology open house in Hutchison Hall, room 316

Jack Werren and John Jaenike speak with Nathaniel Wisch.

Good food, good fun!

To view the slideshow, please visit
www.rochester.edu/College/BIO/melioraopenhouse/melioraopenhouse2013.m4v
(approximately 3 minutes).

MELIORA Weekend

Department of Biology Open House

Friday, October 17, 2014
2:00 – 4:00 PM
Hutchison 316

All alumni, parents, students, faculty, staff and visitors are welcome to attend!

Hors d'oeuvres and Refreshments will be provided.

Chair
John Jaenike
Email: john.jaenike@rochester.edu
Phone: (585) 275-0009

Administrator
Brenna Rybak
Email: brenna.rybak@rochester.edu
Phone: (585) 275-8837

Newsletter Committee
Brenna Rybak (Project Manager)
Cheeptip Benyajati
Xin Bi
Daven Presgraves (Consultant)

For more information about our department, please visit our website at www.rochester.edu/College/BIO/index.php

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Alumni, we want to hear from you!
Let us know what you've been up to.

Send Us Your News

Submit news or feedback

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UNIVERSITY of ROCHESTER