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THE NONSENSE SUPPRESSOR

Newsletter of the Department of Biology
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IN THIS ISSUE

One Hundred and One Graduates to Receive Diplomas at Ceremony

Fifty-eight women and forty-three men are eligible to receive their degrees at the Diploma Ceremony of the Department of Biology being held on Sunday, May 18, 2003, at 2:30 p.m. in the River Road Auditorium. The one hundred and one men and women of the Class of 2003 have satisfactorily completed the requirements for one of the four Biology Department tracks—B.A. in Biology (BIO), B.S. in Biological Sciences: Cell and Developmental Biology (BCD); B.S. in Biological Sciences: Evolutionary Biology and Ecology (BEB), B.S. in Biological Sciences: Molecular Genetics (BMG).

Dr. Robert Angerer, Professor of Biology and Department Chair, will be the Master of Ceremonies,welcoming students and guests and also introducing the faculty speaker, Dr. Thomas H. Eickbush, winner of the Goergen Award for Distinguished Achievement and Artistry in Undergraduate Teaching.

This year's student speaker, chosen by the faculty for excellence in academics and research, and for service to the College, is Prabhjot Dhadialla who will be introduced by Dr. Cheeptip Benyajati, Associate Professor of Biology.

Dr. Martin Gorovsky, Rush Rhees Professor of Biology, will present awards. The Donald R. Charles Memorial Prize, given annually by the Biology Department to students who show great potential and have exhibited excellence in science will be received by Katherine Lander (BEB), David Martinelli (BMG), Prabhjot Dhadialla (BCD), Chad Cornish (BIO), Ke Cheng (BMG), Sian Cairns (BMG). The Janet Howell Clark Prize, awarded by The College to the senior woman who has shown the greatest promise in creative work in one of the following fields—Physics, Chemistry, Biology, Astronomy—and has shown outstanding versatility in the mastery of allied fields, has been won this year by Katherine Lander (BEB).

A slide show, organized by members of the class will be presented just before the awarding of diplomas by Dr. Angerer. Announcement of honors—Phi Beta Kappa and Latin Honors—along with the reading of blurbs written by the graduates will be done by Dr. Anthony Olek (BIO), Dr. Cheeptip Benyajati (BCD), Dr. John Werren, (BEB), Dr. Stanley Hattman (BMG).

A reception will be held immediately following the ceremony in the tent on the front lawn.

The Department of Biology Graduating Class of 2003

Bachelor of Arts

Megha Ambati
Jacques A. Appleby
Amy Wisteria Baughman
Stacy J. Benson
Erin Elizabeth Bonawitz
Gregg Lawrence Chesney
Gregory Scott Clyde
Samantha Elizabeth Colayori
Ian D. Cole
Rebecca T. Cornelison
Chad Matthew Cornish
Gary B. Deutsch
Emily R. Fletcher
Michael C. Fletcher
Jennifer Limina Frustino
Amanda R. Gorman
Benjamin D. Hafensteiner
Michael A. Huba
Aarthi B. Iyer
Hannah Asne Kastenbaum
Michael Geoffrey Katz
Amy T. Kelmenson
Janice Kim
Jennifer Y. Kim
Susannah C. Klank
Joleen C. Lee
Avital Levy
Carmen Elizabeth Lewis-T5
Yongmin Li
Brian Matthew Liebler
Amanda A. Liepke
Jacob J. Luft
Kathleen Anne Lynch
Scott R. Maas
Michael A. Marciano
Deanne Mraz
Swapnil D. Munsaf
Erica D. Musser
Amy C. O'Neil
David A. Orlando
Margaret M. Parisi
Kimberly A. Pulaski
Novella N. Robinson
Delphine R. Robotham
Joshua Steven Rolnick
Jason M. Rotoli
Ilir Rudi
Erin Elizabeth Savery
Naomi Ledene Sayre
Alison H. Schroth
Aizaz L. Shaikh
Rowena C. Singh
Lukasz M. Skomial
Adam William Smotrich
Allison G. Spicher
Jacquelyn A. Staple-T5
Brandi M. Swanier
Jonathan M. Tan
Sonia Tandon
Edmund Tu
Sarada Chandrika Uppuluri
Laura May Wellington
Kelly L. Wentworth-T5
Allison L. Werner
Akshay Yeshokumar
Daniel W. Yoo
Svetlana Zhovtis
Jordan S. Zinn

Bachelor of Science

Biological Sciences: Cell and Developmental Biology

Jennifer A. Bassetti
Angela P.H. Burgess
Bertha Y. Cheng
Prabhjot Singh Dhadialla
Joan M. Doherty
Paul M. Gibas
David I. Lichter
Fiona P. McCulloch
Snehal Rajendrakumar Patel
Ilana M. Schuster
Benjamin B. Solter-T5

Biological Sciences: Evolutionary Biology and Ecology

Nicholas J. Bongio
Eva N. Fung
Matthew J. Groveman
Katherine M. Lander
Alexandra Louise Larson-T5
Jayson J. Lewan
April M. Melvin
Erika L. Mudrak
Julieanne J. Uy

Biological Sciences: Molecular Genetics

Sian E Cairns
Ke Cheng
Christina B. DeVries
Shannon Elisabeth Fishman
Carlton James Hamann
Ali S. Hasan
David J. Heinrich
Christine E. Holmberg
Adam Mikel Kane
Won Ki Lee
Melissa A. Lukose
Stefanie Macaluso
Jonathan C. Marsh
David C. Martinelli
Salvatore Mazza
Sarah Cathleen Peterson
Jeffrey Paul Yaeger
Jordan Qing Lai Zhu

Broad Range of Research Experience Readily Available to Interested Undergraduates

The Biology Department of the University of Rochester, together with the research departments of the School of Medicine and Dentistry located just a five-minute walk away, offers to its majors a diversity of opportunities for engaging in hands-on modern biomedical research. Those opportunities are limited only by students' talents and by their persistence in searching for faculty doing research projects that match their interests. Every year Biology majors engage in laboratory research as volunteers, as student employees, for credit in IND 395, and in the summers as research fellows either at the UR or at other institutions as well as in paying jobs for biotechnology companies.

Independent Research

Twenty-four members of the Biology Department graduating class of 2003 have done one or more semesters of Independent Research for credit. Those students, their faculty sponsors, sponsor's department and number of semesters of research each year are:

Fall 00/Spring 01

Joan Doherty, James Fry, Biology (1);); Prabhjot Dhadialla, Robert Angerer, Biology, (1); Aizaz Shaikh, Elaine Sia, Biology, (1); Julieanne Uy, John Werren, Biology, (1).

Fall 01/Spring 02

Katherine Lander, John Huelsenbeck, Biology, (2); Eva Fung, John Jaenike, Biology, (1); April Melvin, John Jaenike, Biology, (1); Lukasz Skomial, Rita Miller, Biology, (1);

Julie Hull, John Huelsenbeck, Biology, (1); Michael Marciano, John Werren, Biology, (1); Laura Wellington, Robert Quivey, Oral Biology, (1); Jordan Zinn, Fred Hagen, Biochemistry and Biophysics, Ctr Oral Biology, (1); Ke Cheng, Dirk Bohmann, Center for Cancer Biology, (1).

Fall02/Spring03

Paul Gibas, John Jaenike, Biology, (1); Michael Marciano, John Werren, Biology, (1); Nicholas Bongio, John Werren, Biology, (1); Matt Groveman, James Fry, Biology, (1); Chad Cornish, John Jaenike, Biology, (1); Amy Kelmenson, William Merigan, Ophthalmology, (1); Amy O'Neil, John Jaenike, Biology, (1); Allison Werner, Catherine Ovitt, Ctr Oral Biology, (1); Ke Cheng, Elaine Sia, Biology, (2);David Heinrich, David Goldfarb, Biology, (2); Deanne Mraz, Stanley Hattman, Biology, (1); Sian Cairns, Rita Miller, Biology, (1); Daniel Yoo, Martin Pavelka, Microbiology and Immunology, (1).

de Kiewiet Summer Research

The Undergraduate Program in Biology and Medicine (UPBM) has been awarding de Kiewiet Summer Research Fellowships since 1983 to UR students majoring in one of the UPBM tracks. (See article on Summer 2003 Fellows.) Although the number of applicants is small compared to most summer programs, the competition is intense. Students applying must already have a mentor and must submit a detailed research proposal. The summer fellows work full-time in a lab for 10 weeks. Class of 2003 graduates who have been de Kiewiet fellows are: **Ke Cheng**, BMG, **Chad Cornish**, BIO, and **Fiona McCulloch**, BCD. Ke Cheng worked with Elaine Sia, Department of Biology on the project "A fishing expedition--searching for interactors of MSH1p." Chad traveled through several northern states and into Canada sampling the *Drosophila* population under the mentorship of John Jaenike of the Department of Biology. His project was titled "Biogeography of North American *Drosophila*." Fiona McCulloch did research under the direction of Jim Fry also of the Department of Biology. Her project was "Variation of acetaldehyde dehydrogenase activity in *Drosophila melanogaster* populations."

Professional Experiences

Comments from seniors on their career-related experiences give an insight into some of the opportunities available to undergraduates for professional growth at UR and elsewhere.

Christina de Vries (BMG)

Over the past four years, I have worked in the Biochemistry/Biophysics graduate office where I have become an integral part of the staff, made close friends, and made invaluable contacts with the faculty. During the summer of 2002, I worked under Dr. Alan Senior purifying proteins in the F1F0 ATP synthase. This year I volunteered in the Reproductive Genetics Department at Strong Memorial Hospial pursuing my interest in genetic counseling.

Gary Deutsch (BIO)

I have participated in an independent study course at the Medical Center entitled Introduction to Emergency Medicine Research with Dr. Manish Shah. I learned how to conduct proper clinical research and assisted in the planning and data compilation of a study on medical errors in the Emergency Department. As part of my work, I wrote a research paper summarizing and analyzing information gathered during the term. I was also a tutor for the Academic Support Office helping BIO 110 students who were having difficulty in class. These experiences have helped guide me in my decision to become a doctor and apply to medical school. I will be attending Columbia Mailman Public Health School next year.

Hannah Kastenbaum (BIO)

As I think was the story with many students in the Biology Department, I was interested in the field long before I came to UR. My varied experiences over the past four years have mostly helped to solidify and to focus my interests. Certainly my most unique activity was the Summer 2001 externship I arranged and completed with the Berks County Coroner's Office near my hometown in Pennsylvania. Though I worked a regular job in a local nursery and greenhouse, once a week I learned about the human capacity for compassion and grief as I shadowed the deputies in the office, in the field, and several times in the morgue. When I returned to UR in the fall of 2001, I held my first position as an undergraduate teaching assistant for Dr. Hinkle's Principles of Genetics course. As I had found TAs in other courses to be so helpful, I enjoyed the ability similarly to assist my peers. So when I was asked to TA again in the spring of 2003, this time for Dr. Fry's BIO232 Genetic Diversity in Human Populations course, I gladly accepted the opportunity. Between those two activities, I sought the research experience I still lacked. In the spring of 2002, I applied to, and completed that following summer, a research fellowship in the Department of Pharmacology at Loyola University Chicago's Stritch School of Medicine. During that time, I worked to test and to improve a graduate student's adenoviral expression vectors for proteins involved in Parkinson's disease. Though the experience was incredibly enriching, it confirmed my desire to work more closely with people and patients. Through my coursework and all of these opportunities, I have proven the strength of my heart, my stomach, and my mind, and I feel all the more prepared to realize a long-time goal and attend medical school in the fall.

David Martinelli (BMG)

I have had a very rewarding four years at UR although it was frequently stressful and often involved excessive doses of caffeine. One of the most integral parts of my learning experience was actually becoming a teacher myself. I was a teaching assistant for two semesters—once for Dr. Hinkle's course in genetics, and once for Dr. Eickbush's upper level course Eukaryotic Genomes. In Dr. Hinkle's course, my role was to hold recitations and review sessions, and to answer questions from students. With Dr. Eickbush, I had the very unique role of assisting students write scientific essays on topics of their choice.

What I learned from these two semesters was not just a deeper understanding of biological knowledge, but also insights into the learning process which will aid me in teaching situations in my future. I also learned how to learn which helped me in challenging upper level courses.

In the fall I will be attending graduate school at Johns Hopkins University and, although I have no inkling as to what research I will be doing there, I look forward to the experience. And to all those people I annoyed by rollerblading in the halls of Hutchison throughout the years, I apologize. Unfortunately, I have no regrets.

Margaret M. Parisi (BIO)

To explore a career in exotic animal care I worked as a Research Assistant at Seneca Park Zoo for the summer of 2002. I collected and analyzed data on their sea lion's eye health and the relation to the water quality. This led to an opportunity as a Zoo Keeping Aide in which I supported daily animal feeding, cleaning, enrichment, and maintenance through the winter of 2002. Finding that this was not the career for me, I decided, with the guidance and support of Burt Nadler, Director of the UR Career Center, to explore another area of Biology—research. I am currently working as a Lab Technician at the UR Neurosurgery Department in the laboratory of Dr. Berislav Zlokovic whose research focus is on stroke and Alzheimer's. I am fully enjoying working under the supervision of Dr. Tong Cheng, investigating the protective affects of APC (Activated Protein C) on Human Brain Endothelial Cells in conditions lacking oxygen and glucose. Enjoying this field I am strongly considering continuing with graduate school at U R.

Salvatore Mazza (BMG)

Since the spring of my sophomore year I have been working at an OB/GYN lab in the Med Center under the supervision of Professor Morton W. Miller. For the first year and a half I worked on the biological effects of ultrasound on hemolysis of red blood cell membranes. Since then I have been working on the effects of different temperatures on cell growth rates in multiple *in vitro* cell lines.

Sarah Peterson (BMG)

My sophomore year I volunteered in Dr. David Goldfarb's lab where I assisted in the study of protein interactions via the yeast two-hybrid test. Mainly I did basic prep work since it was my first lab experience. This past summer I worked in Dr. Brendan Boyce's lab at Strong. I was given my own project where I tested pharmaceutical agents on mouse splenocyte cells. My project was an early step in the overall goal of finding a drug to aid in the treatment for and/or prevention of osteoporosis. I was given a lot of freedom with the project and was able to assist other researchers in their projects as well. At the close of the summer I gave a talk on my project. In addition, last summer I volunteered on the pediatric ward at Strong through the Friends of Strong program. I was able to give the parents a break while enjoying their children's company.

Adam Smotrich (BIO)

Since I turned 16, I have been extremely involved in Emergency Medical Services. While at UR, I have been active with the Brighton Volunteer Ambulance Company.

Few people realize the responsibility involved in making choices when another human being's fate is in one's hands. Being an Emergency Medical Technician and being the person to make those choices has made me more respectful and sensible, and has allowed me to look at life and help others in a new way. In addition to the gain in knowledge of medicine and the human body, thinking and acting in stressful, confusing situations has built a sense of leadership and confidence in me that will help me in whatever career I decide to pursue. I cannot think of any other activity that I would have liked to have done instead of being on an ambulance and getting a taste of the many different areas of the medical field.

Jeff Yaeger (BMG)

In Summer 2000, I worked in a production lab at Upstate Bio-Tech Inc. in Lake Placid, NY. This company is responsible for filling and completing consumer orders for different reagents, anti-bodies, buffers and protein solutions. I began as a dish-washer but by the time summer was half-way through, I was proficient enough to fill and produce individual orders, being held responsible for the production, quality control, and shipping of the item. My work included protein quantifications, protein purifications and Western blots.

The next summer I worked at Trudeau Institute in Saranac Lake, NY with Dr. Stephen Smiley to help elucidate different key events in the immune response cascade. I helped establish a quantitative

Seniors Share Varied Research Paths Which Have Helped Determine their Destinations

Angela Burgess (BCD)

Almost anyone can attest to the fact that as a young child they were asked several times by several different people, "What would you like to be when you grow up?" To a graduating senior the question of what would you like to be becomes even more pertinent. Initially my curiosity, inspired by undergraduate microbiology as well as cell and developmental biology studies, led me to ask specific questions about the propagation of disease and also the effects of disease on a community. To begin with I pursued these interests as separate endeavors. After spending a summer of research analyzing the effects of a sanitation facility being located next to a hospital, I found that my pursuits could be more fruitful if I could blend interests in public health with exploration of biological foundations of diseases.

During my junior year, I applied to a summer research fellowship at Downstate Medical Center. I was awarded the opportunity to work independently in a research lab on my own project in analysis of the spread of pathogens on a microbial community located next to Kings County hospital. I was able to apply lab techniques to analyze soil samples and water samples near a sanitation facility located next to Kings County hospital to see whether there was an effect on the microbial community next to the hospital. The experiment used Terminal Restriction Length Fragment Polymorphisms (TRFLP) analyses in order to analyze the types of bacteria found in the soil and puddle samples surrounding the sanitation facility. This technique allows for faster identification of a larger variety of bacteria. I was testing the hypothesis that the presence of pathogens would result in higher infection rates among patients. I completed various samplings and also interviewed people within the community, including sanitation workers, to determine if their health status might place them at greater risk for contracting pathogen born diseases. Due to the nature of research and the limited amount of time allowed for this project, results were inconclusive. Future research would include studying whether there was an increase in the spread of infections due to possible tracking of foreign pathogens by doctors and patients who walk past the sanitation facility each day. I would like to continue looking both at a public health side and lab experimentation in order to assess the prevention of the spread of infections and the propagation of infectious diseases.

This summer I will be working with Dr. Steven Dewhurst on a project involving human herpes virus-7 (HHV-7). I will be involved in a project analyzing new gene products encoded by HHV-6 and 7. The long-term goal of the lab is towards the development of the virus, or viral components, in salivary gland gene transfer applications. Next year, I will continue working in Dewhurst's lab, as a student in the PREP program, where I will start on a project that will involve examining novel methods for generation of vaccines for HIV/AIDS specifically, examining the role that the enzymatic infidelity of reverse transcriptase plays in viral mutation and immune evasion. These studies are being conducted using the SIV/macaque model system for HIV/AIDS. I will also be finishing the application process for MD/Ph.D programs.

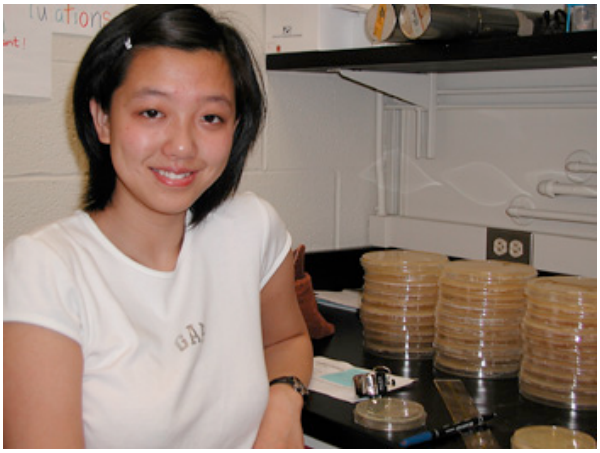
What would I like to be when I grow up? Ideally I would like to have a lab that studies the pathways of transmission of infectious diseases and works to create innovative methods in vaccine development that would influence the medical field. Also, as a physician I would like to work jointly with clinical studies in order to perform epidemiological studies and assess vaccination strategies. The opportunities and the options are endless and I still have a lifetime to decide.

(continued from page 4)

Western blotting assay for fibrinogen and its product, fibrin. We could then measure fibrin levels in tissues during immunity. I also was responsible for genotyping the different mice to be used in the experiments.

This past summer I shadowed an orthopaedic surgeon, Dr. C. Philip Volk, in Plattsburgh, NY. I sat in on surgeries and office visits while also helping check patients into their rooms.

Ke Cheng (BMG)



The University of Rochester has been my home for four years. During this time my knowledge has increased a great deal and therefore I feel indebted to this school and especially to the professors.

I came to America six years ago from the ancient emperor's capital, Xian, China, a place that encompasses five thousand years of civilization and where scholars found a great place for learning. The people pass on through generations the ancient Chinese philosopher's idea that if it were necessary to move three times to find a better education for a child it would be done. My mother didn't mind the distance that we had to travel, crossed half the world and came to America to help me pursue my studies.

Getting through college wasn't easy. When I first came here, I checked the Biology Department website and instantly became interested in the Molecular Genetics major. I thought this major was fabulous because the Human Genome Project was entering its climactic phase that will result in a complete and accurate DNA sequence representing the genetic blueprint and evolutionary history of the human species in the next few years. I was excited and eager to dive into this field of study and to understand how it might unlock the mysteries of disease. I worked diligently for my introductory biology class the first semester, but got a disappointing grade. In the subsequent years I have improved but getting an "A" in biology has never been painless. The amount of material that my professors have taught me in some classes was overwhelming, but at the same time exciting and challenging. Sometimes I wonder why I even got myself into biology instead of physics or math at which I was more competent, but all the doubts disappeared when I found myself amazed by the complexity of mechanisms that have evolved so perfectly to carry out cellular functions: from the electron transport chain, to DNA replication, to apoptosis. Looking back, I believe I have chosen the right major (ever since I saw advisor Hinkle's kind face).

My fascination led me to Dr. Peter Keng's lab at the University of Rochester Cancer Center during the summer after my freshman year. My first project was to investigate the role of p53 in the camptothecin and radiation (Cs-137) induced apoptosis of lung cancer cells H1299 *in vitro*. My second project was to explore the interaction between the clinical anticancer drug taxotere and radiation in human tumor cell lines. During the summer, I overcame the initial failures and difficulties, and learned how to design experiments that answer my questions. Not to mention that I earned a decent amount of money for such an interesting job.

After my first cancer research experience, I couldn't resist continuing to do more. The next summer I worked at Dr. Ute Moll's lab at SUNY Stony Brook to determine whether the p73 protein (a relative of p53 tumor suppressor) translocates to mitochondria during DNA damage mediated apoptosis and my results were cited in a recent publication. In the fall I took an independent study course with Dr. Dirk Bohmann at the Aab Institute of Biomedical Sciences to investigate the potential of *c-Jun* and MAPK signaling in the regulation of DNA repair. During my short stay at the Bohmann lab, I learned an invaluable lesson not only true in science but also in life. When I first started my independent research, I concentrated on the technical skills and did not think about the concept behind my experiments. I began to feel bored, but then came to realize that I need to understand exactly what I'm doing for research to be worthwhile. Continuing to think about what I do and not being afraid to ask questions are principles that I will keep in mind my whole life.

I worked in a number of laboratories before I found my second home in Dr. Elaine Sia's laboratory. I wrote a proposal to use bacterial-2-hybrid to search for interactors of a mitochondrial mismatch repair protein, MSH1p, and was selected as a de Kiewiet Research Fellow. Mutations of mitochondrial DNA contribute significantly to human aging and neuromuscular diseases if they are not repaired. Five promising yeast interactors were identified by bacterial two-hybrid: AAT2, CYS4, THR1, TDH3 and YRF1-2 encoding a Y'-helicase. MAS1, encoding one of the only known Msh1p interactors, was also among the 20 interactors found in this study. We and others have shown that deletion of *AAT2*, *THR1* or *CYS4* in haploid yeast results in the loss of mitochondria function as shown by growth defect on non-fermentable carbon sources. Disruption of *AAT2* function also renders yeast hypersensitive to DNA damaging agents such as MMS and UV irradiation indicating that *AAT2* might have additional role in DNA repair.

My research experience at the University of Rochester has not only increased my knowledge and taught me how to transform textbook science into real experiments but has also helped me to reinforce some of the most valuable qualities: diligence, creativity,

curiosity, honesty, responsibility, and the ability to overcome obstacles. An ancient Chinese proverb says: "The thing that's bigger than the land is the ocean, the thing that's bigger than the ocean is the sky, the thing that's bigger than the sky is the human mind." I love research because I can find answers to the unknown and think without boundaries. I will be continuing my education as a Ph.D student at Cornell University in the fall. I hope my decision to pursue a career in science will contribute to society someday. I will not forget my professors, especially Dr. Sia and Dr. Hinkle, for supporting me and giving me an outstanding education during these four years. Thank you for passing on your knowledge.

Prabhjot Dhadialla (BCD)

As an incoming freshman, I had one goal for my academic education at The College: to be able to think critically. I realized that the particular subject matter I chose to pursue in college was only secondary to acquiring a more fundamental set of skills that would allow me to evaluate, integrate and respond to new ideas in the future. Previous experiences in high school had biased me towards biology, and my time in the Department of Biology has been extremely constructive.

After establishing that I could handle a full college load, I asked Dr. Angerer if I could work in his lab during my second semester. Consistent with the culture of this college—in all departments I have had the pleasure to work closely with—I was able to begin work with excellent guidance and mentorship despite my limited coursework. In the Angerer's developmental biology lab, I began a project to clone and characterize a developmentally relevant transcription factor called the CCAAT factor. In many ways I am fortunate the project did not immediately crystallize—an admission that is much easier to make now, in retrospect. The thought processes that are involved in troubleshooting a problem require a much more critical look at the full range of possibilities inherent in a system than I was able to take. Even problems that aren't meant to be in the system, such as a sloppy technique, or mixed reagents, are important to consider. Furthermore, the experience tested my resolve to stay committed and interested in a project that did not provide immediate gratification. Though we did eventually clone part of this factor, I found myself enamored of a very different kind of problem.

The beauty of studying in a liberal arts environment is finding inspiration for ideas in unexpected places. I had just begun work on a second degree in history, when reading for a class motivated me to think about how social science statistics methods could be applied to work in molecular evolution. Fortunately, a member of the Biology Department (now on the faculty at UCSD) was working on the very same issue. I approached Dr. Huelsenbeck with my idea, and I began two years of extremely stimulating research under his tutelage. Contributing to work in a computational biology lab required that I learn aspects of higher mathematics/statistics, evolution, and computer programming. Using a statistical method called Bayesian Analysis, we worked to reconstruct molecular sequences at the tips of phylogenetic trees. The level of analysis and critical thought required to plan and execute these experiments allowed me to test the limits of my intellect in a satisfying manner.

Coupled with a simultaneous study of history, my understanding of biology, has acquired greater depth and a larger context that will serve as a springboard for future work in the field of medical science. Though my initial goal "to learn how to think critically while in college" was naïve, the education and experiences I have had will allow me to continue reaching for this goal. I will begin PhD rotations this summer, and medical school this fall as part of the Cornell/Rockefeller/Sloan Kettering Cancer Institute's Tri-Institutional MD/Ph.D program in New York City.

Prabhjot Dhadialla has been awarded a National Institutes of Health Medical Scientist Training Predoctoral Fellowship to support medical and graduate research training. He was a 2002 Goldwater Scholar and Editor-in-chief of JUR, Journal of Undergraduate Research, volume 1, issue 1, Fall, 2002.

Prabhjot Dhadialla and Jeffrey Yaeger received the College's Ayman Amin-Salem Memorial Prize for 2003 which is awarded to seniors who evidence the qualities of good character and good citizenship.

Yasser Elshatory (BNS)

Instrumental in sparking my interest in research were several courses I took early in my undergraduate career. I owe it to the professors of these courses to acknowledge them here for having guided me to what passionately drives me: Stanley Hattman's insightful presentation of material in a course I took on Gene Structure & Function my freshman year; David Goldfarb's thought-provoking course in Molecular Cell Biology; Robert Angerer's absolutely fabulous course on Developmental Biology; and Ernie Nordeen's fascinating, research-intensive course in Developmental Neurobiology. These courses either prompted or reaffirmed me in seeking an undergraduate research position.

I was particularly interested in Dr. David Pearce's laboratory in the Center for Aging & Developmental Biology, where I was drawn to the intriguing but also, at that time, ridiculous idea of using *S. cerevisiae* as a model for a human neurodegenerative disease. Dave had reported *BTN1*, a yeast gene orthologue to the human *CLN3* gene whose mutation in its human relative gives rise to an autosomal recessive, pediatric onset neurodegenerative disease called Batten Disease or Juvenille Neuronal Ceroid Lipofuscinosis (JNCL). When disrupted in yeast, *BTN1* serves as a salient model for elucidating the primordial function of *CLN3* by virtue of *BTN1*'s homology to *CLN3*, its localization to the equivalent yeast cellular organelle, and by *BTN1*-disrupted yeast's recapitulating ultrastructural pathology characteristic of Batten Diseased tissue.

As my baptism to the laboratory, during the spring of my sophomore year, and continuing into the summer of 2001 as a de Kiewiet Fellow, I began constructing/screening non-transmembrane domain portions of the human CLN3 protein against a human cDNA library. The rationale was to appreciate some sort of context for the CLN3 protein by way of knowing what it might interact with, to aid in our speculating more rationally about its function. It was a valiant effort.

My current project focuses on changes in markers of dopaminergic cell function in a mouse model for Batten Disease, the *cln3*-knockout mouse. I have followed up on some observations made on JNCL patients describing clinical characteristics often ascribed to Parkinson's disease and schizophrenia. I have identified changes in the mouse model for Batten disease that confirm these observations as well as correlating to alterations in dopaminergic cell function appreciated in patients with JNCL by imaging studies. I am testing to see whether changes in markers of dopaminergic cell function are associated to differences in overlying functional parameters, such as dopamine metabolism and re-uptake, essentially, parameters that would attenuate cell-to-cell signaling mediated by dopamine in the brain.

Having completed essentially all of my degree requirements one year early, what would have been my fourth year at the University of Rochester as an undergraduate became a unique opportunity for me to pursue research full-time, allowing me to fully immerse myself in the laboratory. Although I took on a technical position, my good fortune of being under the mentorship of David Pearce, and the added support and incredible source of enrichment afforded to me by the Post-baccalaureate Research Education Program (PREP), hosted by the Department of Microbiology and Immunology, and directed by Dr. Steven Dewhurst in the Center for Vaccine Biology & Immunology, I was able to function essentially as a graduate student while gaining early instruction in career options in science, graduate science education and post-doctoral training.

I would like especially to thank Dr. David Goldfarb for sharing his philosophy on science with me, and making me feel like I always needed to do more. To Dr. David Pearce I owe a standing ovation for letting me appreciate his scientific rigor, exposing me to quality science, and placing on me the positive pressure of developing as a scientist.

Katherine (Katie) Lander (BEB)

In the winter of my freshman year here at UR, I saw an advertisement in the Buzz from a lab that wanted a volunteer to assist one of the graduate students. Thus began my two-year stint in Dr. John Huelsenbeck's lab. Most of the time I worked with Andrea Betancourt on a project examining the genetic changes that enable viruses to escape antibodies. We tried two methods of exposing the phage to antibodies, but the phage never evolved a higher escape rate. One of the contributing factors may have been that we put the phage through a severe bottleneck in each method and not enough genetic variation remained for evolution to occur. This study would have been significant if it had worked because

if we know how viruses evolve to escape antibodies, we might be able to find a way to keep one step ahead of them in fighting disease.

While in the Huelsenbeck lab, I also did an independent study with Dr. Huelsenbeck on the consistency of parsimony. Parsimony is a method of determining evolutionary trees based on the assumption that the shortest tree is the correct one. We wrote a computer program in C that simulated phylogenetic trees through the birth-death process, then gave the information to parsimony to find out how often it converged on an incorrect tree. Parsimony turned out to be inconsistent a significant proportion of the time. The paper resulting from this project will be published in the journal *Systematic Biology*.

I like working with organisms that I can see, so last summer I accepted a Research Experience for Undergraduates (REU) position at the Institute of Ecosystem Studies in Millbrook, NY. My project was titled, "Habitat creation and biodiversity at small scales: leaf-tying caterpillars as ecosystem engineers." Ecosystem engineers are organisms that directly or indirectly control the flow of resources to other organisms by creating or modifying habitat. Leaf-tying caterpillars tie two or more leaves together with silk to make a protected microhabitat in which they live and feed. While the caterpillars make these shelters only for their own benefit, other insects use these shelters

while the caterpillar is present and after the caterpillar has departed. I found that the caterpillars increase insect biodiversity in red oaks by 50%. I wrote and defended a research paper about this project for my senior thesis at UR.

I had a lot of fun doing research here at UR and also at IES last summer. I discovered that while projects don't always work out, it is still possible to learn something in the process. I also found that I like working outside more than in the lab and that I like discovering new things about the world around me. I would like to continue doing research for a career, so I will begin attending Michigan State University in the fall to get a Ph.D. in Plant Biology and Ecology.

Fiona McCulloch (BCD)

As with many incoming students, when I arrived at the University of Rochester, I wrote down Biology as a major thinking little about why, but seeming confident in my decision to be pre-med. The courses correlated with medical school requirements, so it seemed like a logical choice. I worked through the introductory course work and labs but I still couldn't find a reason for why I was in this program. As the time came to declare a major, I chose Cell and Developmental Biology. At the urging of my advisor, Dr. Cheeptip Benyajati I decided to seek out a job in a lab. I started working as a lab assistant in Dr. James Fry's lab studying population genetics in *Drosophila melanogaster*. At the same time, I was enrolled in a four-credit lab studying developmental and cellular processes in many different organisms. The two experiences could not have been more different, but they both led me to the same conclusion: working in a lab was my reason for pursuing biology.

As I came to the end of my junior year, I realized I wanted to continue doing lab work over the summer. Dr. Fry approached me about applying for a de Kiewiet summer fellowship. This opportunity allowed me to spend ten weeks over the summer researching the ALDH enzyme in *D. melanogaster*. The *Aldh* gene is thought to be responsible for variations in different populations to process ethanol. In humans, *Aldh* genetic polymorphisms occur in high rates in populations with less alcoholism. To look at the variations, I proposed to study the enzymatic activity in two populations of *D. melanogaster*, one that can use ethanol as a food source and one that cannot. By setting up crosses of several lines of flies and assaying for enzyme activity, I was able to show that ALDH activity does vary between populations. My research also isolated which of two suspected structural genes was responsible for the activity of ALDH.

This research opportunity expanded my knowledge beyond the results I obtained. I was given the opportunity to present my research to both faculty and my peers. I am also grateful for the frustrations that come from scientific research. I learned that even though an experiment may not "work out" right there is still much to be gained from learning where you went wrong.

This experience in research was so positive that it caused me to rethink my career plans. I am now planning on working in biotechnology research for a year before going to graduate school. I came into the University of Rochester not knowing why I was a biology major, but I will leave seeing biology as my future.

Rebecca Montange, (BBC)

It was a week before finals, first semester, freshman year. I'd had enough. In high school I volunteered in a clinical lab, but since arriving at the UR my hands had been idle. I was also living off my parent's dole and feeling a bit embarrassed and rebellious about that. After all, I was 3,000 miles from home. Shouldn't I be taking care of myself now? Bottom line: I needed a job and I wanted back in a lab. So I checked the on-campus job board at the Career Center. The Phizicky/Grayhack lab had an opening, so I applied and they snapped me up. They must've been quite desperate because I have since heard Eric Phizicky say he would not hire a first-semester freshman. Either I was an exception or the reason that rule was put into place.

In all fairness, I trained up nicely. So nicely that Eric wrote me a letter of recommendation and I got into the GEBS Summer Scholars program for the summer of 2000. Thrilled at the prospect of doing benchwork again, I celebrated by climbing Mt. Shasta, a 14,192' volcano in Northern California. Then I went back to Rochester to spend my summer screening our GST-ORF fusion protein library for inserts. That's right, I spent a summer doing transformations, mini-preps, and restriction digests. Beth Grayhack can tell you how I felt about that. I never complained, but she knew. The pay-off was delirium and two paragraphs in *Methods of Enzymology*. In an effort to regain my sanity, I went home to Seattle and climbed Mt. Baker, a 10,778' volcano in the North Cascades of Washington. Then I went back to Rochester and the dishes. I loved doing experiments, but I loved groceries more.

Sophomore year was a hectic year featuring three lab courses, EMT training, and my major decision. I came into the UR as a molecular genetics major. I'm coming out as a biochemistry major. I made this subtle yet important switch after taking Genetics (BIO 198) and getting very bored. I've never done so well with so little effort. It was misery. So, in search of a challenge, I changed majors. I also changed my minor from philosophy to chemistry for similar reasons. Maybe one day I will regret it, but today is not that day. To celebrate the successful completion of my sophomore year, I climbed Mt. Baker again, by a tougher, funner route. Then I went to CU-Boulder for an NCI Summer Fellowship.

Boulder was great in a bittersweet sort of way. My experiments did not get me any conclusive data, but I learned how to do an EMSA assay and how to transcribe *in vitro* using a human transcription system. I also totaled my car and received the female equivalent of a Dear John letter. But I was living six blocks from the Flatirons, so after work I'd go hiking and climbing. The mountains are a great place to drown your sorrows and get a great tan. More importantly, I must have made a good impression on the department, because when I went there for their prospective students weekend they remembered me with smiles on their faces, and it felt like I was coming home. So, needless to say, I will be pursuing my Ph.D. in Biochemistry at CU-Boulder next fall.

To salvage my summer, I returned from Colorado and went on a 15-day hiking and climbing trip with my brother. First we circumnavigated Mt. Rainier, a 14,411' volcano three hours south of Seattle. Then we climbed it. The summer went from bittersweet to one of the best in my life in those 15 days. Then I went back to school.

Second semester junior year I started my project. It was voluntary. I was still washing dishes, and leading organic chemistry workshop. To celebrate my step up into the realm of benchwork, I went to Ecuador over Winter Break and climbed a few Andean volcanos. I set myself a new altitude record at 18,709' and learned a new definition of "shortness of breath." Then I went back to school and became our post-doc Jane Jackman's minion. First we made site specifically labeled tRNA substrates. Then we went through the GST-ORF library with them, screening for base-modification activity. Of interest was the methylation

of N1 in the guanosine at the nine position in tRNAGly. Somewhere in the middle of this I won a de Kiewiet Fellowship and classes ended.

I got halfway across the GST-ORF library. Then I went home and climbed Mt. Adams, a 12,300' volcano (yes, I like volcanoes) south of Mt. Rainier. I returned to Rochester with a sunburn and renewed desire to do science. In the second half of the library, pool 47 to be exact, I found it. We named the gene *TRM10* and I got published again. It's in the April issue of *RNA*. To celebrate, my brother and I once again went hiking and climbing at Rainier. We took some different trails this time, and summited by a different route.

When I came back to Rochester, I was no longer a dishwasher. After ~2.5 years, I turned in my wire brush and bottle of soap and switched over to benchwork and leading freshman chemistry workshop. I worked on the kinetics of Trm10p, and wrote a senior thesis. I also took the GREs and applied to graduate schools. In a couple weeks, I'll graduate. A week after that, I'll be testing myself on Mt. Denali, better known as Mt. McKinley. It's 20,320', higher than I've ever been. And it's not volcanic—a not unwelcome change of pace. After that, I'll go to Europe, play at home in Seattle, play in the mountains surrounding Seattle, and move to Boulder where I shall embark on the biggest adventure so far—graduate school.

Erika Mudrak (BEB)

In my sophomore year at UR, after beginning my Ecology and Evolutionary Biology major, I recognized summer as a valuable time to explore research possibilities and to see if I enjoyed research as an academic pursuit. I received NSF REU fellowships that allowed me to spend the next two summers doing research projects at two biological field stations.

At Rocky Mountain Biological Lab in Gothic, Colorado, I worked with Dr. Neo Martinez (SFSU) on the topological structure of food webs. We used the well supported "niche model" to predict the composition of observed food webs given values for size and complexity. I observed predator and prey interactions of four montane meadow plots and constructed food webs for each.

Scores for geographic variability of trophic links were determined using the concept of commonality usually used in determining Species Area Relationships. We devised another "constant connectance in space" model and tested these food webs, using known Species-Area curves and basic properties of the food webs to predict Link-Area Relationships. The model predicted a geographic variability within two confidence intervals of the observed data. This model may be one of the first quantitative theories to accurately predict spatial variation of food-web structure.

At University of Virginia's Blandy Experimental Farm near Winchester, Virginia, I worked with Dr. Michael Wise, now at Bucknell University. Our research focused on the possibility of evolution of tolerance in plants. Resistance mechanisms (such as toxic chemicals or spines) lessen damage by reducing herbivore preference or performance. Tolerance can be viewed as the result of re-growth or reallocation that allow the plant to compensate for herbivore damage. I exposed several genetic lines of horsenettle to various levels of two types of herbivory. Lace bugs caused leaf damage which affected the plants autotrophic abilities, and weevils chewed off the buds that would become

flowers needed for fruitset. Both leaf damage and bud removal was detrimental to plant fitness, but I found very little genetic variation. I found that if there are no foliar herbivores, tolerance is costly for the plant; resources may be stored in reserves that are never used. In the presence of herbivores, there is a neutral selection for tolerance. With regard to bud removal by weevils, tolerance was beneficial in high levels of bud damage, but had no cost in the absence of weevils. Resistance and Tolerance studies are currently implemented to help breeders maximize output of crops, and to find more efficient uses of pesticides.

Both of these experiences immersed me not only in the project I was conducting myself, but in a community of scientists and researchers. I was able to learn about other undergraduates, projects, the thesis work of the graduate students, and the current undertakings of the station faculty. Both labs had weekly seminar speakers, exposing me to even more diverse fields of study. With a whole world of different research to explore, I will spend the next year at several more of these field stations working on different projects, and then going on to graduate school. This summer I am working at Cedar Creek Natural History Area, University of Minnesota's Long Term Ecological Research Site.

Stephen Salipante (BMB)

My first experience with laboratory science was that of washing glassware in Dr. Barry G. Hall's laboratory, a job I started during the spring semester of my freshman year. I made a concerted effort to finish my work as quickly as possible so that I would be able to shadow everyone in the lab and ask questions about the research projects being conducted. Happily, they got the hint, and I was invited to work as a researcher in Dr. Hall's lab during the summer of 2000. After that point, I never left the lab; for the past three calendar years I have conducted research under the guidance of Dr. Hall in the form of independent research projects and internships and with the aid of undergraduate research fellowships. My research career has focused on the topic of antibiotic resistance, specifically the origins and evolution of antibiotic resistance genes.

Having the ability to predict how antibiotic resistance genes are likely to evolve in the future could greatly aid the escalating battle against antibiotic resistant microbes. Such information would permit the development of antibiotic treatment regimes and novel antibiotics that could be used to combat organisms expressing evolved genes. One of my first projects was to artificially evolve an antibiotic resistance gene, the aminoglycoside acetyltransferase *aac(6')-Iaa*, with the goal of predicting what capabilities that gene may evolve in the future. Briefly, I created populations of mutagenized alleles through PCR amplification using a mutagenic DNA polymerase, a process that has been shown to introduce the same kinds of mutations at the same frequency that occurs in nature. I cloned the mutant alleles into an expression vector and transformed into *E. coli* to produce genetic libraries which were then selected for individuals exhibiting greater aminoglycoside antibiotic resistance than that conferred by the wild-type gene. I was unable to recover any allele that conferred greater levels of antibiotic resistance than the wild-type; that negative result was nevertheless important. The library sizes I produced in the project were large enough to ensure that I screened alleles of *aac(6')-Iaa* containing every possible single amino acid substitution and every possible combination of double amino acid substitutions. Naturally occurring mutations generally occur in a gene one at a time, and occasionally two will occur simultaneously. Because the evolution of antibiotic resistance genes requires that each mutation confer an increase in resistance, it is unimportant to consider the effects of more than two simultaneous base substitutions. Therefore, we can conclude that gene *aac(6')-Iaa* has reached an evolutionary maximum, and will be unable to evolve further into a better antibiotic resistance gene via natural pathways.

I have also been interested in identifying genes that may represent new sources of antibiotic resistance, such as antibiotic resistance gene homologs. As their name indicates, antibiotic resistance gene homologs are defined as genetic or protein sequences that exhibit significant homology to known antibiotic resistance genes or proteins. Using phylogenetic methods, I identified a number of sequences that appear to share a common evolutionary history with the family of metallo-beta-lactamase resistance genes; resistance genes of clinical importance on account of their ability to confer resistance to a wide range of beta-lactam drugs (such as penicillins, cephalosporins, carbepenems, etc.). To determine if any of the metallo-beta-lactamase homologs I identified could function as antibiotic resistance genes, I cloned four of them into expression vectors and assessed whether they could confer enhanced resistance to a variety of beta-lactam drugs. Two of the cloned homologs were found to confer modest, but significant increases in antibiotic resistance to multiple beta-lactam antibiotics. Because they have inherent ability as beta-lactamases, homologs such as those may represent a starting point for the evolution of new resistance genes if given sufficient time and selective pressure.

Cryptic antibiotic resistance genes, like antibiotic resistance gene homologs, may represent new sources of antibiotic resistance. Cryptic antibiotic resistance genes are those which are capable of conferring increased levels of antibiotic resistance but are (curiously) not expressed by the organisms in which they reside, even after that organism is exposed to appropriate antibiotics. Because cryptic antibiotic resistance genes do have the ability to be expressed after appropriate mutations occur, they represent a functional, but latent reservoir of antibiotic resistance—and it is a reservoir which may naturally reside in a number of important human pathogens. In light of this fact, it is in our interests to find where these resistance genes reside, and what they can do.

Phylogenetic methods are useful for identifying cryptic antibiotic resistance genes that bear significant homology to known antibiotic resistance determinants, however, they are limiting in the respect that they do not allow the identification of novel resistance genes which lack sequence similarity to known resistance determinants. To avoid this

problem, cryptic antibiotic resistance genes that lack significant homology to known resistance determinants must be identified based on phenotype alone. That is why we developed the GeneHunter system: it is a transposon tool that can be used to activate and identify cryptic antibiotic resistance genes on the basis of the phenotype they confer. Briefly, large chunks of genomic DNA from the organism of interest are cloned into fosmid vectors and transformed into *E. coli* to produce genetic libraries. GeneHunter transposon is randomly integrated into those libraries, and expression of cryptic antibiotic resistance genes is achieved by a strong outward reading promoter encoded on the transposons. The GeneHunter libraries can then be screened for isolates exhibiting increased antibiotic resistance to any number of drugs, and the activated genes are easily identified by sequencing.

Using *Salmonella typhimurium* LT2 as a test organism I was able to develop effective methods of library construction, and from the libraries I created, to isolate and identify the known cryptic antibiotic resistance genes present in that organism. When applied to other organisms, the GeneHunter system may be used to identify cryptic antibiotic resistance genes which lack structural or functional homology to any known resistance determinant.

I certainly feel that my undergraduate research experience has prepared me for a higher education in the biological sciences. Beginning this summer, I will be pursuing an MD/Ph.D dual degree at the University of Washington, in Seattle. Needless to say, I am looking forward to it.

Laura Wellington (BIO)

It started back in high school. You know how sometimes you can have a teacher who really piques your interest in some way. That is precisely what my high school biology teacher did for me. I remember that she had us do dissections, perform experiments to visualize biological processes, and do role-playing activities to better understand such topics as natural selection. I remember feeling intrigued by the world around me and wondering about physical explanations for natural processes.

For me, this curiosity goes far beyond the study of biology. It also appears in my interest in such things as wilderness experiences and travel. I have been blessed to be able to explore the world through these venues; I spend my summers leading wilderness expeditions in Canada and I spent this past fall semester studying in Costa Rica.

My interest in biology falls clearly into this realm of curiosity into the world around me. Even through my various travels, I am constantly aware of my surroundings and the way that the natural world is put together. Biology was quite a logical choice of majors for me once I reached college. It has indeed stimulated and challenged me in so many ways, enabling me to continue to pursue my interest in the exploration of many physical processes.

One of the most valuable experiences that I have had as an undergraduate student of biology has been the work that I have done in the Quivey lab at the URMC. I was fortunate to start as a sophomore in the lab and worked for two years, culminating with an independent research project.

The Quivey lab focuses the majority of their research on a certain bacterium, *Streptococcus mutans*. This specific bacterium is considered to be the major etiological agent in causing dental caries. It lives in the oral cavity and metabolizes ingested carbohydrates. The result of *S. mutans'* sugar fermentation is lactic acid as a by-product, which leads to tooth decay and enamel demineralization when the acid build-up occurs in dental plaque.

My research focused on the isolation of a certain gene within the S. *mutans* genome, *mar R*. One of the graduate students in the lab had been working on the isolation and analysis of a number of genes that had been shown to be involved with the formation and maintenance of the lipid bi-layer membrane that surrounds the internal environment of the cell. My project was connected to her work because the gene with which I was working, *mar R*, was contiguous with one of these known genes and they were suspected to be transcribed together. The hypothesis was that the *mar R* gene was somehow involved in the transcriptional regulation of these other known genes, and therefore involved in the maintenance of the lipid bi-layer as well.

My research allowed me to apply many of the biological concepts that I had learned through course work, and also to learn many new techniques and experiments that are used in the laboratory setting. I want to sincerely thank everyone in the Quivey lab, particularly Dr. Robert Quivey and Ms. Elizabeth Fozo

for their guidance and patience as I worked and learned in their lab.

I am not sure if biological research is necessarily going to be in my future, but my drive to continue learning about the physical world certainly will be. It is hard to believe that my time as an undergraduate is coming to a close, but as I look back, I feel blessed to have experienced the world through the lens of the University of Rochester these past four years and I look forward to creating my own experiences in the years to come.

Eight UPBM Graduates Earn Distinction in Research

The Undergraduate Program in Biology and Medicine (UPBM) provides majors in the B.S. or B.A. tracks the opportunity to graduate with distinction in research. Students must achieve a minimum GPA of 2.7 and must defend their written thesis at a meeting of their advisory committee. Most students seeking a degree with distinction have worked on a research project for a year or more and have achieved significant results. They then immerse themselves in the time-consuming process of writing the thesis. Those who successfully complete their research and then push on to write the required paper are rewarded with the phrase "Distinction in Research" added to their transcripts.

The eight members of the class of 2003 who have earned the honor of "Distinction in Research" are:

Andrew Berti, BMB, whose project "Are Pmscl2p and Rrp6p functional homologues" was undertaken with the guidance of J. Scott Butler of the Department of Microbiology and Immunology.

Chad Galloway, BBC major whose project "Expression and characterization of APOBEC-1 complementation factor splice variants" was carried out under the sponsorship of Harold Smith, Department of Biochemistry & Biophysics.

Lisa Johns, BBC major whose project "Functional analysis of members of the APOBEC related protein (ARP) family and their potential auxiliary factors" was mentored by Harold Smith, Department of Biochemistry & Biophysics.

Katherine Lander, BEB major whose project "Habitat creation and biodiversity at small scales: leaf-tying caterpillars as ecosystem engineers" was completed under the direction of Tom Bannister, Department of Biology.

Rebecca Montange, BBC major whose thesis "Identification and characterization of a yeast m1G2tRNA" was directed by Eric Phizicky, Department of Biochemistry & Biophysics.

Hetal Patel, BMB major whose project "Activity and Stability of Site-Specific RhlR Mutants of *Pseudomonas aeruginosa*" was mentored by Barbara Iglewski, Department of Microbiology and Immunology.

Stephen Salipante, BMB major whose project " On the discovery of new antibiotic resistance genes" was directed by Barry Hall, Department of Biology.

Matthew Tremblay, BNS major whose project "Neurogenesis and epilepsy" was done with Shirley Joseph, Department of Neurosurgery.

de Kiewiet Research Fellowships Awarded to Eight UPBM Majors for Summer 2003

Eight undergraduates majoring in Biology and four of the B.S. tracks of the Undergraduate Program in Biology and Medicine (UPBM) have been awarded de Kiewiet Research Fellowships for the summer of 2003. The de Kiewiet Fellowships were established in 1983 in memory of former UR president C.W. de Kiewiet. Every year since then they have provided the opportunity for UPBM undergraduates to spend the summer doing research full time. This year each Fellow will receive a stipend of $3,000 for ten weeks of research in the laboratory of a University researcher.

Listed below are the recipients of the 2003 de Kiewiet Summer Research Fellowships, their projects and their mentors.

Evan Kingsley, BCD major, class of 2004, began his laboratory experience as a dishwasher and media maker in the lab of Dr. David Pearce in the department of Biochemistry and Biophysics. He

quickly took on extra responsibilities and soon was training new undergraduates to wash the dishes while he went on to participate directly in the group's research project. For the past two summers Evan has been a guest student in a biology lab at the Woods Hole Oceanographic Institution under Dr. Cabell Davis. There he helped analyze underwater video and assisted in programming the video capture system. His project this summer, "Retinal pathology of the *Cln3*$^{-/-}$ mouse model of juvenile neuronal ceroid lipofuscinosis," will take him into a quite different world.

Matthew Maurer, BMG major, class of 2004, has evolved from considering himself pre-med, to thinking an MD/Ph.D. program would be good, to deciding to focus on a Ph.D. program leading to a career in research and teaching. He has had two summers of experience at SUNY Upstate Medical Center in Syracuse in the Cell and Developmental Biology lab of Dr. James McCasland starting with grunge work and moving up to designing protocol. This summer Matt will be testing his skills and creativity in Dr. Elaine Sia's lab in the Department of Biology. His project is "Additional protein factors involved in mismatch repair of the mitochondrial genome in *Saccharomyces cerevisiae*."

Mark O'Hara, BMG major, class of 2004, begins his summer research fellowship with no experience in a laboratory outside of the chemistry and biology lab classes he has taken. Yet his genuine interest in and enthusiasm for research coupled with his quick grasp of the difficult topic of *Tetrahymena* genetics led Dr. Martin Gorovsky of the Biology Department to agree to be his research advisor for the summer. Mark's project is titled, "Analysis of PAZ and PIWI domains on the function of TWI1 in *Tetrahymena*."

Niraj Patel, BBC major, class of 2004, is another neophyte when it comes to doing research outside a laboratory class setting. He, too, is eager to begin applying what he has learned to a project of his own. Dr. Ravi Basavappa of the Department of Biochemistry and Biophysics believes that Niraj has the intellectual aptitude and enthusiasm to become an excellent scientist and will be mentoring him over the summer. After college Niraj plans to go on to graduate work, perhaps seeking a job with a biotechnology company and going to school at the same time. His summer project is "Analysis of E2-APC interactions in the cell cycle."

Rebecca Porter, BBC major, class of 2004, has been described as extremely focused, motivated and committed. Influenced by the biology and chemistry courses she has taken at the University of Rochester, Rebecca has broadened her original plan of going to medical school to include the possibility of an MD/Ph.D program. Since last June she has done research in Dr. Ming Qi's molecular genetics lab in the Department of Pathology and Laboratory Medicine. This summer she will work with Dr. Yi-Tao Yu in Biochemistry and Biophysics. Her project is "Toleration of non-conserved branch point sequences of pre-mRNA as a proposed function for pseudouridines located in the branch point binding sequence of U2 snRNA."

Anne Stey, BNS major, class of 2004, has been involved in research since the summer of 2001 when she had two internships in Ohio. In the summer of 2002 she was a Summer Fellow in the Strong Children's Research Center and during the last two academic years she has been doing research in Dr. Shey-Shing Sheu's lab in Pharmacology and Physiology. The de Kiewiet fellowship will allow Anne to work full time in that lab on her own project, "Identifying the role of the mitochondrial ryanodine receptor in neurotoxicity." Anne hopes to pursue an MD/Ph.D program after graduation.

Kelly Wentworth, BIO major, class of 2004, is a Take 5 scholar who has had teaching experience as an anatomy and physiology lab TA and as an organic chemistry workshop leader. She has been employed for the past year as a laboratory assistant in the lab of Dr. Michael Pichichero in the Department of Microbiology and Immunology. And last summer she was a volunteer student intern in clinical laboratories in Rhode Island. Her ambition is to become a physician and she views the ability to understand and participate in research as necessary in modern medicine. Kelly will be working with Dr. Luojing Chen in the Center for Human Genetics and Pediatric Disease. Her research topic is "Identification of interacting proteins of the protein kinase PKK by a yeast two hybrid screen."

During the summers following her freshman and sophomore years, **Cornelia Zorca**, BMG major, class of 2004, worked as an intern in the laboratory of Dr. William Konigsberg at the Yale University School of Medicine. This summer she will be researching "Localization of scnRNAs in macronuclear development in *Tetrahymena thermophila*" in Dr. Martin Gorovsky's Biology Department lab at UR. Cornelia is committed to research but thinks she might pursue an MD/Ph.D program after graduation. Her summer of research, followed by a year of continued work on her project, as well as further seminars and advanced courses should help to decide her future.

Behind-the-Scenes Support Produces Successfull Performance—All in a Day's Work for Lab Preparator

Three new multi-section teaching laboratories were introduced beginning in 1998 as part of a revision of the biological sciences curriculum at the UR. A laboratory in introductory biology and two sophomore laboratories—in genetics and in molecular cell biology—were crafted to introduce modern experimental approaches and to promote the development of strong experimental design and analysis skills. The plan was to revise continuously the laboratories incorporating new experiments that reflect the active nature of science inquiry and carefully to introduce new teaching methods. The first step in this ambitious plan was to find someone with excellent managerial skills, great patience, breadth of knowledge, and most importantly the ability to translate good ideas into good practice. We were fortunate in finding the perfect person for this daunting task—Bev Mihalenko.

Entering Bev's work space is entering a room to delight the curious. Micropipetters and microtiter plates are found beside paramecium cultures. There are little domes over fern gametophytes. Sheep brains occupy the counter across from the space filling DNA model which in turn looms over a petri dish with something fascinating growing across the surface. This melange reflects the range of expertise which Bev applies each day as she preps labs from genetics to cell biology to biodiversity with a little bit of developmental and molecular biology on the side. Bev says that one of the things she really likes about her job is that she gets to do something different all the time.

According to Bev, "We have a great pool of graduate and undergraduate TA's. My job is to help them so that they can concentrate on teaching and working with students without worrying about the prep work." According to Linn Sajdak, that help extends to lab designers and coordinators as well. Linn recalls the mealy bug invasion of the green house that wiped out all of the coleus needed for lab the next week. The bad news was revealed to Linn only after Bev had come up with an alternate source for the plant material. Bev's comment went something like, "I didn't want you to worry. You're busy enough."

Heidi Henley, now a graduating senior, has been a Lab Instructor in Bio 111 for three years in a row. When asked about her experience with teaching she replied, "Bev, has always been extremely helpful and playful all in one. She always keeps her cool, even when students try to pipette hot melted agar without using a pipette tip. She just calmly corrects them and fixes the pipette. She's a great teacher, and a great help to TAs and to their students. I couldn't imagine teaching lab for three years without Bev; I probably never would have done it. I would have stayed with recitations or workshops; she made the experience so much easier and more enjoyable for me and for the students."

Bev's background includes three years as a technician at the New York State Agricultural Experimental Station in Geneva, NY. She worked on a project to transform coffee with a toxin gene from the bacteria *Bacillus thuringiensis* (BT gene) to protect the coffee bean from damage by beetle larva. She also worked as the prep person for Biology Labs at Finger Lakes Community College in Canandaigua. Her most recent job before coming to UR was as a school aid in the Pal-Mac middle school.

Bev is a home grown Rochesterian, born at Strong Memorial Hospital. She recounts her family story back to her grandfather who is a part of Strong Memorial Hospital history. He was the proprietor of the Association of the Blind Snack Bar until his death in 1959. His picture can be found in the photo archives located in the ground floor hospital corridor. She graduated from Gates Chili High School. She has four children ages 31, 28, 21 and 18, the youngest her only daughter. Jim, 28, is a graduate of the University of Rochester in history and political science. He is the father of her 1 and 8/9 grandchildren (8/9 at least as this article goes to press). In her spare time she says she likes to, well—. She says, "I like to think about what I would do if I had any spare time!" She did manage to crochet 12 pairs of booties for her first grandson, Jonathan, and

hopes to get the sweater done before 8/9th becomes grandchild number 2. Her husband Marty is employed at Xerox as a Program Manager.

The staff, lab instructors and students join in thanking Bev for the wonderful job she has done. Successful student labs are all about the behind the scenes organization and preparation. Her excellent work is reflected each day when students and teachers walk into the lab. With her continued help we can look forward to many more years of exciting learning at the University of Rochester.

Congratulations

Awards

Martin A. Gorovsky, Rush Rhees Professor of Biology has been chosen as this year's recipient of the University Award for Graduate Teaching. This award is given annually to one faculty member in the University (i.e. SMD, Warner, Eastman, Simon, The College). It recognizes Marty's efforts in the classroom and especially in mentoring almost two dozen students through their Ph.D research. Many of these have gone on to prominent positions in academia and other areas of science and many of these also wrote in warm support of Marty's impact on their careers.

Andrea Betancourt has been awarded an NSF Doctoral Dissertation Improvement Grant. This will help support her research from June 1, 2003 to May 31, 2005. Andrea is performing experimental evolution studies in an RNA bacteriophage. These studies focus on the genetics of adaptation. In particular, she is performing repeated whole genome sequencing on lines of phage that are adapting to novel conditions. This allows her to determine the number, identity, and fitness effects of the genetic changes underlying adaptation.

Daven Presgraves has won the prestigious Theodosius Dobzhansky Prize awarded annually by the Society for the Study of Evolution to "recognize the accomplishments and future promise of an outstanding young evolutionary biologist."

Kelly Dyer was chosen by the University to receive the Edward Peck Curtis Award for Excellence in Teaching by a Graduate Student. She received $500 for her outstanding teaching efforts and the department received $250 to improve undergraduate course materials or laboratory equipment.

For the second year in a row, three Rochester undergraduates have been named Goldwater Scholars: juniors Gautam Altekar, computer science major; **Maximilian Popp**, molecular genetics major; Sarah Zubairy, mathematics major. This award is endowed by the U.S. Congress and is designed to encourage outstanding students to pursue advanced degrees and careers in mathematics, the natural sciences and engineering.

Lab Assignments

Five graduate students completing their first year have been assigned to the labs in which they will do their doctoral research. **Leah Jablonski** will work in Elaine Sia's lab; **Han Liu** will join Rulang Jiang's lab; **Jonathan Millen** has chosen David Goldfarb's lab; **Nitin Phadnis** will be mentored by Jim Fry and Allen Orr; **Karin Tetzlaff** has joined Tom Eickbush's lab. Two other students will do a fourth rotation—Sarita Ahlawat, Sandhya Sharma.

Grants

David Goldfarb has been awarded a new NIH RO1 grant, "Gating the Nuclear Pore Complex Translocon." The grant will run from 2003-2007 and will pay $1,100,000.

Jack Werren received an NIH Nathan Shock Grant on "Aging in *Nasonia*" for 2002-2003 and an American Rosacea Society award for "Intracellular bacteria in *Demodex* mites" for 2002-2003.

Arrivals and Departures

Dr. **Kathleen Karrer** has returned to Marquette University after a successful sabbatical in the Gorovsky lab.

Dr. **Miriam Barlow** will be leaving her postdoctoral position in Barry Hall's lab in May to take a position as a Postdoctoral Fellow at Emory University in Atlanta, Georgia.

Lars Olsen joined the Goldfarb group in March as a lab tech IV.

Bonnie Baxter will be joining the Goldfarb group in June as a Ph.D Research Associate.

Adam Mason will be reincarnated as a postdoc in the Goldfarb lab after he defends his Ph.D. thesis this summer.

Graduate student **Adam Green** was granted a leave of absence to serve in the US Peace Corps from June of this year until approximately September of 2005. He will be serving in Cameroon, Africa where he will be teaching biology, chemistry, physics, English and other subjects to secondary students and primary school teachers. Before he leaves for Africa, he is taking a solo cross-country trip on his motorcycle, visiting national parks and crossing about 40 states.

Off Campus

Tom Eickbush gave a talk entitled "Retrotransposons that propagate in the nucleolus" at the Keystone Symposia On Transposition and other Genomic Rearrangements, Santa Fe New Mexico, February 4-8, 2003. At the same meeting two members of the laboratory, Dr. Shawn Christensen and Junqiang Ye, gave posters entitled " DNA footprint and mobility shift studies of the R2Bm retrotransposition reaction" and "The impact of chromatin structure on the R2 retrotransposition reaction."

David Goldfarb is on the Steering Committee for the Second Annual Meeting on Yeast Apoptosis which will take place in Slovakia in September. Dave spoke at Hobart and William Smith Colleges in January; at the Medical College of Wisconsin in Milwaukee in February; and will be attending the Gordon Conference: Autophagy in Stress, Development and Disease Autophagy at Colby College in Vermont in June.

Marty Gorovsky was an invited speaker at the University of Connecticut Health Center, Department of Biochemistry on January 30. On March 8, Marty gave a talk at the Thirtieth Annual Biology Symposium at York University, Toronto, Canada. Marty also presented his research on April 3 at the University of Maryland, Baltimore County, Department of Biological Sciences.

Barry Hall gave talks at the Evolution of Infectious Disease Meeting at N.I.H. in August 2002 and at the Biology Department of the University of Louisville, Louisville, KY, in October.

Stan Hattman performed with **Sankofa**, the African Dance and Drum Ensemble, at its SUNY Brockport annual shows May 1-4.

John Jaenike gave seminar talks at Washington State University, SUNY Buffalo, University of Chicago, Ithaca College, and University of Cincinnati.

Jack Werren gave seminars on "*Wolbachia*: Bacterial manipulators of eukaryotic reproduction" at Department de Biologia, University de Sao Paulo, Brazil (2003), Department of Zoology, University of Washington (2002), Department of Ecology and Evolution, Yale University (2002), Microbial Evolution: Concepts and Controversies, Montreal, Canada (2002), Department of Microbiology & Molecular Genetics, Harvard Medical School (2002), Department of Pediatrics, UR Medical School (2002), Department of Molecular Cell and Developmental Biology, U.C. Santa Cruz (2002). Additional presentations were: Department of Microbiology & Immunology, UR (2003), "*Wolbachia*: Implications to Medicine and Eukaryotic Evolution"; Department of Biology, University of Maryland (2002), "The evolution of wing size in *Nasonia* species"; Germ Cells, CSHL Symposium (2002) "Vertical transmission of bacterial symbionts", Second International *Wolbachia* Conference, Kolymbari, Greece (2002); "*Wolbachia* and speciation: where things stand now"; Department of Veterinary Medicine, University of Milan, Italy (2002). "Sex ratio evolution and manipulation by endosymbionts", Behavioral Ecology and Evolution of Microorganisms Symposium; American Society of Microbiology Meetings, Salt Lake City, Utah (2002), "*Wolbachia* and eukaryotic speciation"; Evolution of Developmental Diversity, Cold Spring Harbor Laboratory (2002): "Evolution of wing cell-size regulation in *Nasonia*".

Jack taught a short course on Genetic Conflict at Department de Biologia, University de Sao Paulo, Brazil in March 2003.

Recent Publications

Eickbush

Eickbush, D. G. and T.H. Eickbush. 2003. Transcription of endogenous and exogenous R2 elements in the rDNA gene locus of *Drosophila melanogaster*. Mol. Cell. Biol. 23, in press.

Burke, W.D., D. Singh and T.H. Eickbush. 2003. R5 retrotransposons insert into a family of infrequently transcribed 28S rRNA genes of *Planaria.* Mol. Biol. Evol. 20, in press.

Fry

Fry, J.D. and S.V. Nuzhdin. 2003. Dominance of mutations affecting viability in *Drosophila melanogaster*. Genetics 163:1357-1364.

Messina, F.J. and J.D. Fry. 2003. Environment-dependent reversal of a life history trade-off in the seed beetle *Callosobruchus maculatus*. Journal of Evolutionary Biology 16:501-509.

Fry, J.D. Multilocus models of sympatric speciation: Bush vs. Rice vs. Felsenstein. Evolution, in press.

Fry, J. D. 2003. Detecting ecological trade-offs using selection experiments. Ecology, in press.

Goldfarb

Roberts, P., S. Moshitz-Moshkovitch, E. Kvam, E. O'Toole, M. Winey and D.S. Goldfarb. 2003. Piecemeal microautophagy of the nucleus in yeast. Mol.Biol.Cell 14:129-141.

Goldfarb, D.S. 2003. Microautophagy of the *Saccharomyces cerevisiae* nucleus. In Autophagy, ed. D.J. Klionsky, Landes Bioscience, Georgetown, TX.

Shulga, N. and D.S. Goldfarb. 2003. Binding dynamics of structural nucleoporins govern nuclear pore complex permeability and may mediate channel gating. Molec. Cell. Biol. 23:534-542.

Gorovsky

Ren, Q. and M.A. Gorovsky. 2003. The nonessential H2A N-terminal tail can function as an essential charge patch on the H2A.Z variant N-terminal tail. Mol. Cell Biol. 23:2778-2789.

Hall

Barlow, M. and B.G. Hall. 2002. Phylogenetic analysis shows that the OXA β-lactamase genes have been on plasmids for millions of years. J. Mol. Evol. 55:314-321.

Hall, B.G. 2002. Predicting evolution by *in vitro* evolution requires determining evolutionary pathways. Antimicrob. Agents Chemother: 46:3035-3038.

Hall, B.G. 2002. Experimental evolution of antibiotic resistance. APUA Newsletter 20, No. 4: 4-5.

Hall, B.G. 2003. The EBG system of *E. coli*: Origin and evolution of a novel β-galactosidase for the metabolism of lactose. Genetica, in press.

Barlow, M. and B.G. Hall. 2003. Experimental prediction of the natural evolution of antibiotic resistance. Genetics 163:1237-1241.

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M. Barlow and B.G. Hall. 2003. Experimental prediction of the evolution of cefepime resistance from the CMY-2 AmpC β-lactamase. Genetics, in press, May 2003 issue.

Hall, B.G., S. Salipante and M. Barlow. 2003. The metallo-β-lactamases fall into two distinct phylogenetic groups. J. Mol. Evol, in press.

Hall, B.G. and M..Barlow. 2003. Structure based phylogenies of the serine β-lactamases. J. Mol. Evol., in press.

Hattman

Lima, S., J. Hildenbrand, A. Korostelev, S. Hattman and H. Li. 2002. Crystal structure of an RNA helix recognized by a zinc-finger protein: An 18 base pair duplex at 1.6 Å resolution. RNA 8:924-932.

Zinoviev, V.V., A.A. Evdokimov, E.G. Malygin, S.L. Schlagman and S. Hattman. 2003. Bacteriophage T4 dam DNA-[N^6-adenine] methyltransferase. Processivity and orientation to the methylation target. J. Biol. Chem. 278:7829-7833.

Roberts, R.J., M. Belfort, T. Bestor, *et al.* 2003. A nomenclature for restriction enzymes, DNA methyltransferases, homing endonucleases and their genes. Nucl. Acids Res. 31:1805-1812.

Malygin, E.G., V.V. Zinoviev, A.A. Evdokimov, W.M. Lindstrom Jr., N.O. Reich and S. Hattman. 2003. DNA-[cytosine- N4]- and [adenine-N6]-methyltransferases have different kinetic mechanisms but the same reaction route: a comparison of M.BamHI and T4 Dam. J. Biol. Chem. 278:15713-15719.

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Jaenike

Jaenike, J. and T.A. Markow. 2003. Comparative elemental stoichiometry of ecologically diverse *Drosophila*. Functional Ecology 17:115-120.

Perlman, S.J. and J. Jaenike. 2003. Infection success in novel hosts: an experimental phylogenetic study of *Drosophila*-parasitic nematodes. Evolution 57: 44-557.

Perlman, S.J. and J. Jaenike. 2003. Evolutionary dynamics of virulence in associations between *Drosophila* and their parasitic nematodes. Evolution, in press.

Perlman, S.J. and J. Jaenike. 2003. Evolution along the virulence spectrum: a case study of *Drosophila* and their nematode parasites. Nematology, in press.

Taylor, J.E. and J. Jaenike. 2003. Sperm competition and the dynamics of X chromosome drive in finite and structured populations. Annales Zoologici Fennici, in press.

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Orr

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Orr, H.A. 2003. Darwinian storytelling (review of Steven Pinker's The Blank Slate: the Modern Denial of Human Nature). The New York Review of Books, February 27, 2003, pp. 17-20.

Orr, H.A. 2003. "The Blank Slate": an Exchange. The New York Review of Books, May 1, 2003, pp. 48-49.

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Presgraves, D.C. 2002. Patterns of postzygotic isolation in *Lepidoptera*. Evolution 56: 1168-1183.

Betancourt, A.B., D.C. Presgraves and W.J. Swanson. 2002. A test for faster X evolution in *Drosophila*. Molecular Biology and Evolution 19: 1816-1819.

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Presgraves, D.C., L. Balagopalan, S.A. Abmayr and H.A. Orr. 2003. Adaptive evolution drives divergence of a hybrid inviability gene between two species of *Drosophila*. Nature, in press.

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Werren

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Werren, J.H., M.J. Hatcher and H.C.J. Godfray. 2002. Maternal-Offspring Conflict Leads to the Evolution of Dominant Zygotic Sex Determination. Heredity 88:102-111.

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M. Lachmann, N.W. Blackstone, D. Haig, A. Kowald, R.E. Michod, E. Szathmáry, J.H. Werren and L. Wolpert. 2003. Cooperation and conflict in the evolution of genomes, cells, and multicellular

organisms. In Genetic and Cultural Evolution of Cooperation. Dahlem Conference Publications, Berlin GE, in press.

Bordenstein, S.R. 2003. Symbiosis and the origin of species. In: Bourtzis K, Miller T (eds) Insect Symbionts, CRC Press:New York. Pp. 283-304.

Baudry, E., K. Emerson, T. Whitworth and J.H. Werren. 2003. *Wolbachia* and genetic divergence patterns in the birdnest blowfly *Protocalliphora sialia*. Molecular Ecology, in press.

Bordenstein, S.R., D.H.A. Fitch and J.H. Werren. 2003. Absence of *Wolbachia* in Nonfilariid Nematodes. J. Nematology, in press.

Bordenstein, S.R., J.J. Uy and J.H. Werren. 2003. Host genotype determines *Wolbachia* cytoplasmic incompatibility type in *Nasonia*. Genetics, in press.

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