



Biochemistry Welcomes Dr. Richard Cummings as Professor and Chair

The Department of Biochemistry welcomes Dr. Richard D. Cummings as the William Patterson Timmie Professor and Chair, effective July 1, 2006. Dr. Cummings is a nationally recognized expert in the emerging research field of “glycomics.” Prior to Emory, Dr. Cummings was the George Lynn Cross Distinguished Research Professor of Biochemistry and Molecular Biology at the University of Oklahoma Health Sciences Center where he also held the Ed Miller Endowed Chair in Molecular Biology, was Professor of biochemistry and molecular biology, and Director and founder of the Oklahoma Center for Medical Glycobiology. In addition, in 1999, Dr. Cummings was appointed co-director/coordinator of the newly established University of Oklahoma Bioengineering Center. Before joining the University of Oklahoma, he was professor of biochemistry at the University of Georgia and Associate Director of the UGA Complex Carbohydrate Research Center.

The National Institutes of Health (NIH) has identified the field of “glycomics” as a major new research focus, and Dr. Cummings has played a key role in the multi-institutional Consortium for Functional Glycomics funded by the National Institute of General Medical Sciences (NIGMS). Glycomics is defined as the



Richard D. Cummings, Ph.D.

scientific pursuit of identifying and studying all of the carbohydrate molecules produced by an organism and their functions.

Dr. Cummings’s research focuses on glycoconjugates, the carbohydrate molecules and their associated proteins and lipids that permit cells to

communicate with and adhere to each other — transmitting and receiving chemical, electrical and mechanical messages that underlie all cellular and bodily functions. His research has a particular emphasis on the role of glycoconjugates in cardiovascular biology, autoimmune diseases, and parasitology. A hallmark of his research team has been the promotion of collaborative studies and training in glycobiology, and he has partnerships with more than a dozen other laboratories.

“It is my great honor to become the chair of the Department of Biochemistry at Emory University School of Medicine,” said Dr. Cummings. “It is a privilege to join such an outstanding group of faculty, fellows, students and staff. I look forward to working with everyone in the coming years to help the department grow and continue to be recognized for its outstanding research and teaching. I also want to acknowledge the excellent work of Dr. Dean Danner, who has served as interim chair, and thank him for his service.”

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New Biochemistry Chair, from page 1

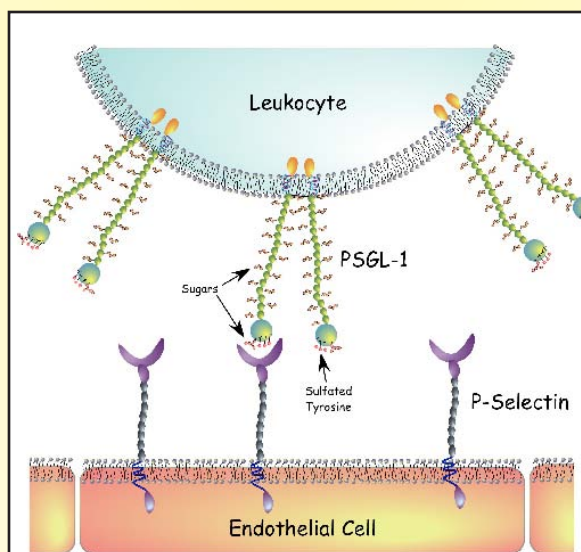
“I am very pleased to have Dr. Cummings join our School of Medicine, particularly as one of the initiatives in the University’s new Strategic Plan is fundamental scientific research,” said Thomas J. Lawley, M.D., Dean, Emory University School of Medicine. “Dr. Cummings is widely recognized as a ground breaker in biochemistry, and his leadership will be invaluable as we move past the human genome project into undiscovered territory and the next level of medical advancement.”

After receiving his bachelor’s degree from the University of Montevallo in Montevallo, Alabama, Dr. Cummings earned his doctoral degree from The Johns Hopkins University. He was a postdoctoral fellow in Hematology/Oncology at the Washington University School of Medicine in St. Louis. Dr. Cummings has served in numerous leadership roles at the NIH and in professional organizations. He is a member of the NIH Oncology Fellowship Review Panel, the Steering Committee for the Consortium for Functional Glycomics at NIGMS, and a permanent member of the NIH study section on Pathogenic Eukaryotes and an ad-hoc member of the Tumor Microenvironment study section.

Dr. Cummings is past president of the Society for Glycobiology and is currently a member of the American Society of Parasitologists, the American Chemical Society, the American Society for Cell Biology, the American Society for Biochemistry and Molecular Biology, and the American Association for the Advancement of Science (AAAS). He is associate editor of *Glycoconjugate Journal* and former associate editor of *Biochemical Journal*. He serves on the editorial boards for the journals *Glycobiology*, *Glycoconjugate Journal*, and *Biochimica et Biophysica Acta* and is a past member of the editorial board of the *Journal of Biological Chemistry*. He has

been the principal investigator or co-principal investigator for eight NIH grants over the past 5 years and he is a frequent invited lecturer and has directed the research of more than 50 postdoctoral fellows, research associates, visiting scientists, and doctoral and masters degree students.

Dr. Cummings has authored over 160 peer-reviewed journal publications and dozens of textbooks or book chapters. In addition, he is an editor of *Essentials of Glycobiology*, the first textbook in glycobiology. He holds 24 patents and has served as a scientific advisor for Amgen, Inc., Ross Laboratories/ Abott Laboratories, Genzyme, Neose Technologies, and Valeo Medical, Inc. He was co-founder in the 1980s of the Athens, Georgia startup company ELA Technologies, created to develop bioluminescent proteins for enhanced detection and sensitivity in immunoassays. He serves as co-founder, president, and chief scientific officer of Selexys Pharmaceuticals Corporation in Oklahoma City, a University of Oklahoma Health Sciences Center startup company begun in 2002 with a pipeline of therapeutics for the treatment of inflammatory diseases.



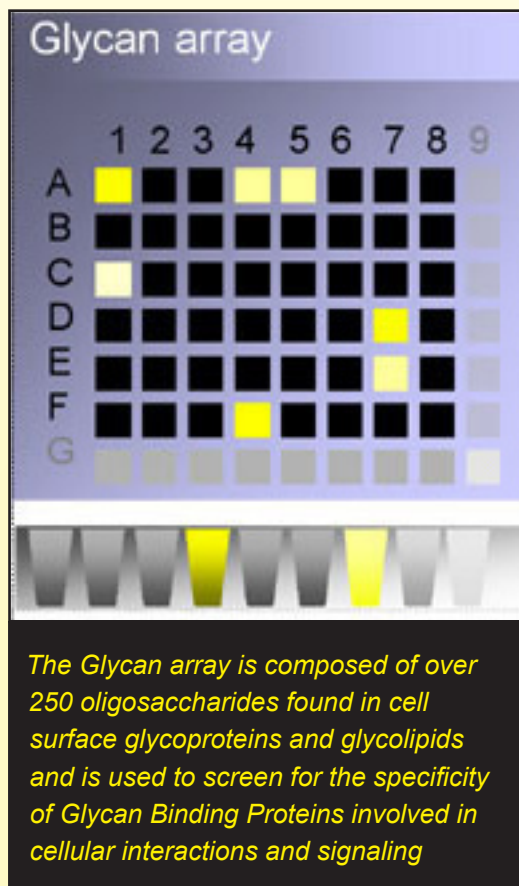
Human white blood cells adhere or stick to the endothelium of blood vessels during inflammation through binding between P-selectin receptor and the counter-receptor PSGL-1, which occurs through carbohydrate-protein interactions

The Core H Facility at Emory University

Dr. Richard Cummings has transferred his Core H Facility from the University of Oklahoma Health Sciences Center to Emory's Department of Biochemistry. The Core H facility is part of the Consortium for Functional Glycomics (CFG), a large research initiative funded by the National Institute of General Medical Sciences (NIGMS) of the NIH. The consortium is comprised of an administrative core and seven scientific core facilities located at prestigious research institutions in the United States and Europe.

Dr. Cummings and Dr. David Smith, Ph.D., Director of Core H at Emory and a newly appointed Professor in the Biochemistry Department, have moved the lab cross the country, along with several staff members and the rest of Dr. Cummings's laboratory, including Tongzhong Ju, M.D., Ph.D., who will be a new Assistant Professor in the Department of Biochemistry.

The Scientific Core Facilities (designated A through H) are producing a variety of resources and services to investigators for use in performing experiments that contribute to our understanding the roles of carbohydrate-protein interactions at the cell surfaces in cell-cell adhesion and cellular



signaling. Core H is the central resource for conducting glycan binding specificity and affinity studies for a wide range of projects initiated by Participating Investigators. The central technique in Core H is the screening of Glycan Binding Proteins (GBP) on microarrays of defined oligosaccharides, glycopeptides, and glycoproteins. The Core has developed a process for receiving samples and reporting data that encompasses communication, sample handling, glycan array manufacture, standardized assays, data processing, data upload, and data dissemination. The data generated by Core

H are made available to Participating Investigators and deposited in the database where it also becomes available to the public according to Consortium policy.

In the last few years Core H, which is one of the most popular technology resources developed by the Consortium, has seen dramatic growth in the number of resource requests from researchers to screen samples on the glycan array. The unique aspect of the glycan array is that dedicated funding supports the level of resources needed to build and grow an array of glycans on an unprecedented scale and is freely available to researchers world-wide.

The future aim of Core H is to extend and improve novel technologies to aid Participating Investigators in a broad range of disciplines to explore how protein-glycan interactions influence cell communication and adhesion in many biological systems, including roles of glycoconjugates in innate and acquired immunity and host-pathogen interactions.

For more information on the Consortium for Functional Glycomics and its Core Facilities, please visit <http://www.functionalglycomics.org/static/consortium/main.shtml> and <http://www.functionalglycomics.org/>

Wilkinson Lab Publishes Study of the USPs Deubiquitinating Enzyme in *Cell*

Researchers from the Wilkinson lab have uncovered new information about a central regulator of the ubiquitin system. Ubiquitin is an essential protein that helps regulate the amount and location of other proteins within cells. Because ubiquitin plays a key role in various processes in cells, scientists believe drugs could eventually be developed to target parts of the ubiquitin system in treating diseases such as cancer.

The study was published in the March 24th issue of *Cell*, with Francisca Reyes-Turcu, a graduate student in the Wilkinson lab, as the first author.

Keith Wilkinson, Ph.D., senior author, has been investigating ubiquitin since the late 1970s, as a research fellow in the laboratory of Irwin Rose, one of three scientists awarded the 2004 Nobel Prize in Chemistry for the discovery of how ubiquitin facilitates protein degradation within cells.

Dr. Wilkinson and Ms. Reyes-Turcu report for the first time on how ubiquitin binds to Isopeptidase T (IsoT), an enzyme responsible for disassembling chains of ubiquitin (also known as polyubiquitin chains). Since the initial research on ubiquitin, scientists made the observation that modification of a substrate protein with ubiquitin chains directs the substrate protein to the proteasome (a structure inside cells that breaks down protein) for degradation. Dr. Wilkinson and Ms. Reyes-Turcu focused on IsoT because of its pivotal role in recycling ubiquitin from ubiquitin chains and since it represents one of

the few known polyubiquitin binding proteins.

“Although scientists knew that IsoT had an essential role in the recycling of ubiquitin, the structure of IsoT and how it recognized and bound to polyubiquitin chains was not understood,” said Reyes-Turcu.

While researchers had not yet understood how IsoT and ubiquitin might fit together, they have known that IsoT regulated ubiquitin-dependent metabolic pathways. Understanding how IsoT recognizes polyubiquitin chains can provide further understanding on how other polyubiquitin receptors can recognize this cellular signal.



Dr. Keith Wilkinson and Ms. Francisca Reyes-Turcu

Ms. Reyes-Turcu focused on the role of a “zinc finger domain” of IsoT (ZnF UBP domain of IsoT). Zinc finger domains consists of amino acid residue held together by a zinc ion. Using x-ray crystallography—a technique used in imaging at the molecular level—she provided the first images of the ZnF UBP domain of IsoT showing that a ubiquitin chain binds to IsoT by inserting one end of a chain into a pocket on the zinc finger domain.

“Most of biology is driven by two proteins interacting in some way,” Dr. Wilkinson notes. “The original idea was that these interactions were like a lock and a key, with shapes that were completely complementary and just fit together. This concept has been refined as people have realized that both molecules can breathe and move.”

Dr. Wilkinson and Reyes-Turcu added that their findings would not have been possible without the assistance of Dr. Xiaodong Cheng, PhD, and Dr. John Horton, PhD, both from the Cheng lab in the department of Biochemistry, who collaborated with Dr. Wilkinson and Reyes-Turcu in solving the X-ray structure of the ZnF UBP domain of IsoT.

“The results of this work are an example of a valuable collaboration that makes science fun and exciting,” adds Dr. Wilkinson.

The structure of the ZnF UBP domain of IsoT represents the first structure of this class of domains to be crystallized. Because it is present in other proteins implicated in the ubiquitin system, these other proteins may recognize ubiquitin in a similar way to IsoT.

Dr. Wilkinson adds, “The knowledge that we gain from the zinc finger structure could allow us to design a drug to occupy that pocket and modulate the activity of the ubiquitin pathway to treat certain diseases.”

The study was funded by the National Institutes of Health and the American Heart Association. The article is on display in the glass case outside of the main Biochemistry conference room, 4th Floor, RRC.

Devine Lab Develops New Map of Genetic Variation in Human Genome

Dr. Scott Devine and his laboratory have discovered 400,000 insertions and deletions (INDELs) in the human genome that signal a little-explored type of genetic difference among individuals. INDELs are an alternative form of natural genetic variation that differs from the much-studied single nucleotide polymorphisms (SNPs). Both types of variation are likely to have a major impact on humans, including susceptibility to disease.

The INDEL research will be published in the September issue of the journal *Genome Research*. The article is currently posted ahead of print at the *Genome Research* website, www.genome.org.

The human genome sequence in our DNA contains three billion base pairs of four chemical building blocks--adenine, thymine, cytosine, and guanine (A, T, C, G), strung together in different combinations in long chains within 23 pairs of chromosomes. Scientists now know that humans share about 97-99 percent of the genetic code, and the remaining 1-3 percent dictates individual differences. These naturally occurring differences, called polymorphisms, help explain differences in appearance, susceptibility to diseases, and responses to the environment.

SNPs are differences in single chemical bases in the genome sequence, and INDELs result from the insertion and deletion of small pieces of DNA of varying sizes and types. If the human genome is viewed as a genetic instruction book, then SNPs are analogous to single letter changes in the book, whereas INDELs are equivalent to inserting and deleting words or paragraphs. Most polymorphism

discovery projects have focused on SNPs, resulting in the International HapMap Project--a catalog and map of more than 10 million SNPs derived from diverse individuals throughout the globe. Dr. Devine and postdoctoral researcher Ryan Mills, Ph.D., focused instead on INDELs, using a computational approach to examine DNA re-sequences that originally were generated for SNP discovery projects. Thus far they have identified and mapped 415,436 unique INDELs, but they expect to expand the map to between 1 and 2 million by continuing their efforts with additional human sequences.

“We’re entering an exciting new era of predictive health where an individual’s personal genetic code will provide guidance on healthcare decisions,” says Dr. Devine.

Dr. Devine says INDELs can be grouped into five major categories: (1) insertions or deletions of single base pairs; (2) expansions by only one base pair (monomeric base pair expansions); (3) multi-base pair expansions of 2 to 15 repeats; (4) transposon insertions (insertions of mobile elements); (5) and random DNA sequence insertions or deletions. INDELs already are known to cause human diseases. Cystic fibrosis is frequently caused by a three-base-pair deletion in the CFTR gene, and DNA insertions called triplet repeat expansions are implicated in fragile X syndrome and Huntington’s disease. Transposon insertions have been identified in hemophilia, muscular dystrophy and cancer.

“We’re entering an exciting new

era of predictive health where an individual’s personal genetic code will provide guidance on healthcare decisions,” says Dr. Devine. “Our maps of insertions and deletions will be used together with SNP maps to create one big unified map of variation that can identify specific patterns of genetic variation to help us predict the future health of an individual. The next phase of this work is to figure out which changes correspond to changes in human health and develop personalized health treatments. This could include specific drugs tailored to each individual, given their specific genetic code.”

Dr. Devine believes the technology holds the promise of predicting whether a person will develop diabetes, mental disorders, cancer, heart disease and a range of other conditions.

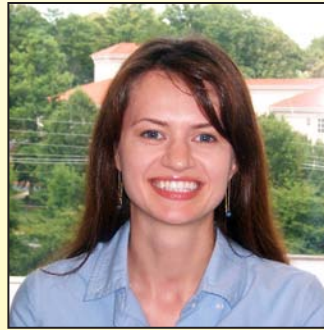
The researchers used data from the University of California, Santa Cruz, the SNP Consortium, the HapMap Consortium, and dbSNP. All the INDELs identified in the study have been deposited into dbSNP--a publicly available SNP database hosted by the National Center for Biotechnology Information. The National Human Genome Research Institute of the National Institutes of Health funded the research.

Dr. Devine and his colleagues have received national media attention for their work including an *Associated Press* story posted on several hundred news sites across the country including the *NY Times*, *Washington Post*, *Newsday*, *CBS News*, and the *Atlanta Journal-Constitution* along with a separate story in *Nature*, found at www.nature.com/news/2006/060807/full/060807-15.html. Dr. Devine was also interviewed on *National Public Radio*.

New Faculty & Staff



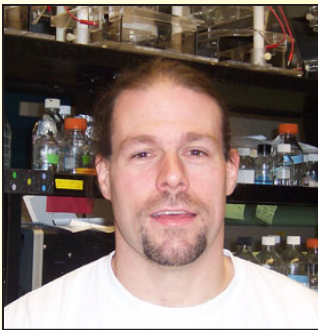
Rajindra Aryal
Graduate Student; BCDB
Cummings Lab



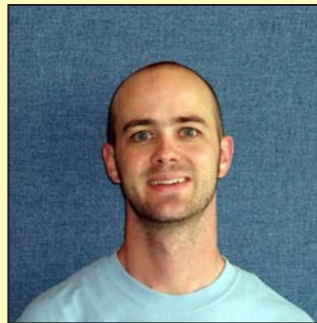
Zhanetta Astakhova
Graduate Student; BCDB
Wilkinson Lab



Richard D. Cummings, Ph.D.
William Patterson Timmie
Professor and Chair



Paul Domanski
Lead Research Specialist
Pallas Lab



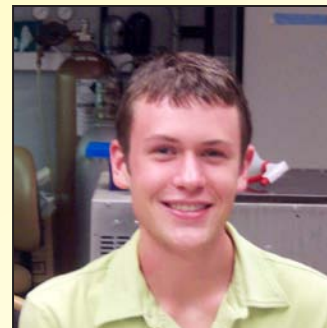
Brett Israel
Graduate Student; BCDB
Wilkinson Lab



Thomas "TK" Johnson
Lead Research Specialist
Cummings Lab

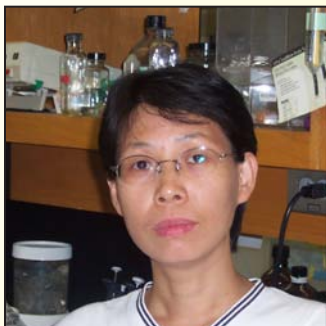


Tongzhong Ju, M.D., Ph.D.
Assistant Professor
Cummings Lab

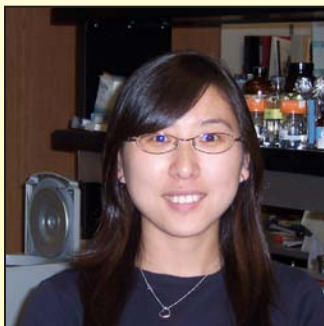


Jason Larson
Undergraduate Student
Pallas Lab

New Faculty & Staff *continued*



Keqin Li, Ph.D.
Postdoctoral Fellow
Cheng Lab



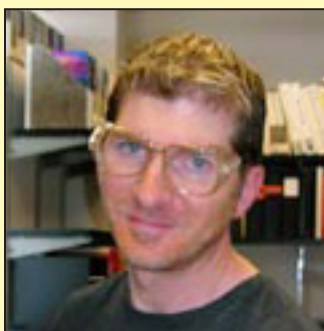
Yuting Li
Graduate Student; Chemistry
Edmondson Lab



Anthony Luyai
Graduate Student; BCDB
Cummings Lab



Lydia Morris
Graduate Student; GMB
Doetsch Lab



Trey Perkins, M.D., Ph.D.
Radiation Oncology Resident
Doetsch Lab



Justin Rodgers
Lead Research Specialist
Pallas Lab

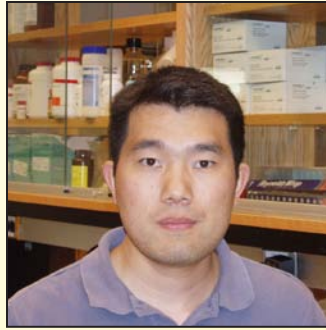


Kristen Slanina
Lead Research Specialist
Cummings Lab



David F. Smith, Ph.D.
Professor and Director of
the Protein-Carbohydrate
Interaction Core H Facility
Cummings Lab

New Faculty & Staff *continued*



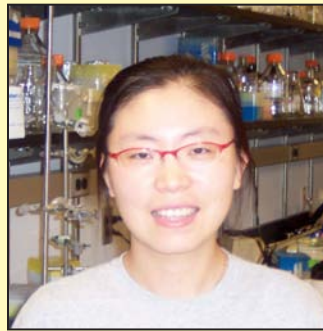
Xuezheng Song, Ph.D.
Postdoctoral Fellow
Cummings Lab



Suchita Sood
Research Specialist
Doetsch Lab



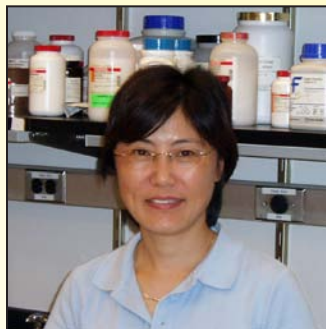
Sean Stowell
M.D./Ph.D. Program Student
Cummings Lab



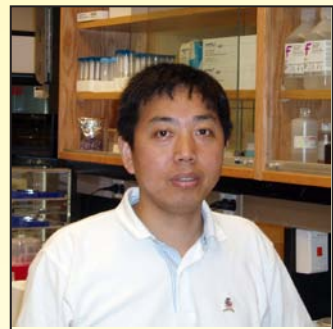
Qian Sun
Graduate Student
Cummings Lab



Myrna Torres
Senior Research Specialist
Cummings Lab



Yingchun Wang, Ph.D.
Associate
Cummings Lab



Baoyun Xia, Ph.D.
Associate
Cummings Lab

Faculty Speaking Engagements

RICHARD D. CUMMINGS, PROFESSOR

- ▶ June 2006, Invited Lecture, Dept. of Biological Chemistry, The Johns Hopkins University School of Medicine, Baltimore, MD
- ▶ July 2006, Invited Lecture, 20th IUBMB International Congress of Biochemistry and Molecular Biology, Kyoto, Japan
- ▶ July 2006, Invited Lecture, GLYCOT2006 Meeting in Tsukuba, Japan
- ▶ July 2006, Invited Presentation, Satellite Meeting of GLYCOT2006 in Nikko, Japan

PAUL DOETSCH, PROFESSOR

- ▶ January 2006, Invited Lecture, National Institute of Environmental Health Sciences, Research Triangle Park, NC
- ▶ February 2006, Invited Lecture, Dept. of Pharmacology, Univ. of North Texas Health Sci. Ctr, Fort Worth, TX
- ▶ March 2006, Invited Lecture, Environmental Toxicology Ctr, Univ. of Texas Medical Branch, Galveston, TX
- ▶ May 2006, Invited Lecture, Ninth International Workshop on Radiation Damage to DNA, Tekirova, Antalya, Turkey
- ▶ May 2006, Invited Lecture, Microorganism Models of Genetic Instability Symposium, 106th General Meeting of the American Society for Microbiology, Orlando, FL
- ▶ August 2006, Invited Lecture, Gordon Research Conference on Mutagenesis, Salve Regina University, Newport, RI

DALE EDMONDSON, PROFESSOR

- ▶ July 2006, Invited Lecture, along with Anup Upadhyay (Postdoc in the Edmondson Lab), 12th Annual Amine Oxidase Meeting in Rotterdam, The Netherlands

ICHIRO MATSUMURA, ASSOCIATE PROFESSOR

- ▶ May 2006, Invited Lecture, NIH/NIAID-Nordic Regional Research Networking Mtg, Helsinki, Finland
- ▶ May 2006, Invited Lecture, Rinat Neuroscience, South San Francisco, CA
- ▶ June 2006, Invited Lecture, Gordon Research Conference on Biopolymers, Newport, RI
- ▶ February 2007, Invited Lecture, Department of Biochemistry, University of Minnesota, Minneapolis, MN

DANNY REINES, PROFESSOR

- ▶ November 2006, Invited Lecture, Transcriptional Regulation by Chromatin and RNA Polymerase II Meeting, ASBMB, Kiawah Island, SC

KEITH WILKINSON, PROFESSOR

- ▶ April 2006, Invited Lecture, ASBMB Symposium honoring Irwin A. Rose, San Francisco, CA
- ▶ May 2006, Distinguished Graduate Lecturer, 2006 Student Awards, Department of Biological Chemistry, University of Michigan, Ann Arbor, MI
- ▶ May 2006, Invited Lecture, Ubiquitin for Drug Discovery and Development, Philadelphia, PA
- ▶ July 2006, Invited Lecture, Gordon Research Conference on Proteases and Inhibitors, Meriden, NH
- ▶ July 2006, Invited Lecture, FASEB Summer Conference on Ubiquitin, Saxtons River, VT

Accomplishments & Awards

CONGRATULATIONS

to **DR. KEITH WILKINSON** who has been named Vice Chair of the Department of Biochemistry. As a well-respected member of the department, he has made important contributions to both the teaching and research at Emory. As Vice-Chair, Dr. Wilkinson's primary responsibilities will be to act as Chair in Dr. Cummings's absence and to provide guidance to the department as it expands over the coming years.

JIN
WANG,

a Chemistry

Graduate Student in the Edmondson Lab, received 1st prize for her poster section entitled, "Do Monomeric vs. Dimeric Forms of MAO A Make a Difference? A Direct Comparison of the Catalytic Properties of Rat and Human MAO A's," at the 12th Annual Amine Oxidase Meeting in Rotterdam, The Netherlands,

1st Prize

Birth Announcement



JACK CHRISTOPHER PALLAS

Born January 2006

to David and Jennifer Pallas and proud older brother, Ethan, age 2

CONGRATULATIONS!

Several members of the Biochemistry faculty have served on NIH Scientific Review Groups this past year including:

DR. DALE EDMONDSON: *Molecular Structure and Function A or MSFA* study section

DR. DANNY REINES: *Molecular Genetics - B* study section

DR. ANITA CORBETT: Chair, *F05 Cell Biology NRSA* study section (July 2006, and again in November 2006)

Others currently serving on NIH Scientific Review Groups are:

DR. RICHARD CUMMINGS: *Pathogenic Eukaryotes* study section

DR. KEITH WILKINSON: Regular member, *Membrane Biology and Proteolytic Processing* study section