Fall is here once again, and with this issue of the BioHawk, we bring you news of major achievements from across the University and in the Biological Sciences. KU has had record-breaking enrollments for the 2008-2009 academic year, with a total of 30,102 students on the Lawrence, Edwards, and KU Medical Center campuses. In addition, U.S. News and World Report just ranked us number 40 on its annual list of the top public universities in America, and the ACT scores for KU’s newest freshman class are almost three points above the national average. Within the Biological Sciences, for the second year in a row, our graduate program has been ranked 30th among public universities.

On pages 2-9, the Director of the Undergraduate Biology Program (KUUB), and the Chairs of the Departments of Ecology and Evolutionary Biology (EEB) and Molecular Biosciences (MB), all highlight recent events and achievements involving their faculties and students. We also provide updates on the reorganization of the biological sciences on page 18. With three cooperative and coordinated units, we are more competitive than ever at national and international levels.

In this issue, we also focus on KU’s emerging programs in the neurosciences and genetics, and to our understanding of human behavior. As we noted in last year’s BioHawk, Dean Joseph Steinmetz holds faculty appointments in the Department of Psychology as well as our own Department of Molecular Biosciences, and he currently has undergraduates, graduate students, and postdoctoral fellows working in his lab on the neurobiology of learning and memory. In addition, we highlight the research program of one of our newest faculty members in MB, Dr. Stuart Macdonald. Dr. Macdonald uses Drosophila fruit flies as a model system to address fundamental questions about the molecular genetic basis of variation in complex traits, and his research has important implications for understanding disease risk in humans.

On page 19, we highlight Biological Sciences alumnus Dr. Randy Scott. Randy is the co-founder, chairman, and CEO of Genomic Health, Incorporated in Redwood City, California. Randy’s company is helping to lead the way towards individualized cancer treatment in America.

We also thank all of the Biological Sciences contributors whom we list on page 21. Your thoughtful support is deeply appreciated by all of us, and we urge you to stay in touch, and return to the KU campus as often as possible. Even as KU grows, it retains its beauty and it remains enriched by the incredibly strong Jayhawk tradition that you enjoyed so much as students.
2009 Calendar

- Alumni Spring Lecture – Thursday, April 16, 2009
- Alumni Board Meeting – Friday, April 17, 2009
- Recognition Ceremony – Saturday, May 16, 2009
- Commencement – Sunday, May 17, 2009

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The University of Kansas is committed to providing programs and activities to all persons, regardless of race, religion, color, sex, disability, national origin, ancestry, sexual orientation, marital or parental status and, to the extent covered by law, age or veteran status.

We would like to thank everyone who contributed to making this issue of BioHawk a success. Without your support it would not be possible. A special thanks to all of those who contributed material and images.
Joining the research laboratory of one of our Biological Sciences faculty members can be one of the most rewarding experiences of our students’ four years at KU. Undergraduate research provides our students with opportunities to acquire new knowledge and skills, and provides exciting intellectual challenges that simply cannot be provided in the classroom environment alone. Many students become so captivated by research that they pursue departmental Honors, and the Biological Sciences hosted the 2008 Honors Research Symposium the weekend just before spring Commencement. Six graduating seniors were individually recognized by Honors Committee Chair Dr. Daphne Fautin, and each gave an exciting oral presentation of their work. Working with faculty advisors Dr. Rafe Brown and Dr. Linda Trueb, Kyle Hesed described his research on a mitochondria-based phylogeny of Sphenomorphus lizards in the Philippines.

In addition, Anne Vezeau discussed her undergraduate studies of courtship behavior by a song-less species of Drosophila fruit flies, which she performed in the laboratory of Dr. Jenny Gleason. Nashenna Naguib Jiwa highlighted her research on T cell development with Dr. Thomas Yankee at the KU Medical Center, and Elspeth Pearce spoke about her analyses of the genetics of Drosophila leg development in Dr. Rob Ward’s lab. Ryan Townley talked about his research on the house mouse behavior with Dr. Rudolf Jander, and Fikri Birey presented his comparative studies of the developmental genetic basis for bilateral flower symmetry between two model plant species (Mimulus guttatus) in the laboratory of his mentor Dr. Lena Hileman.

Undergraduate research in the Biological Sciences was highlighted as well at the 8th Annual University of Kansas-Haskell Indian Nations University Undergraduate Research Symposium, which was held on 29 April 2008 at the Haskell Indian Nations University campus. Almost two thirds of the 31 student participants from KU and Haskell presented results from biological science projects completed under the guidance of KU faculty mentors. This exciting conference was organized by KU’s Office of Diversity in Science Training, which focuses on four main objectives:

- Train tomorrow’s scientists, who reflect the population diversity of the nation as a whole.
- Achieve scientific excellence by fostering a diversity of perspectives and points of view.
- Invite students to participate in hands-on lab experiences as undergraduate research scholars.
- Assign mentors who can engage students in rigorous scientific inquiry and reinforce successful critical thinking skills, and
- Introduce students to biomedical research careers by attending symposia, and by giving students the opportunity to present their research at professional events.
Our undergraduates also do more than coursework and research, however! An exceptional group of 134 dedicated Upperclassmen in the Biological Sciences assisted us during the past year as Undergraduate Teaching Assistants (UTAs), both in our classrooms and in our teaching laboratories. For example, 31 of these UTAs assisted Dr. Julie Campbell in making our entry-level courses for non-majors (BIOL 100 and BIOL 102) and for majors (BIOL 150/151 and BIOL 152/153) a tremendous success. These UTAs provide unique connections with the students whom they teach because they, too, are still pursuing their undergraduate degrees. In addition, they serve as wonderful role models for our incoming freshmen, because only the best and very brightest of our applicants are chosen to hold this key teaching role. Without question, UTAs help to create an unusually productive, positive, and enjoyable learning environment for our students in introductory biology.

In May, KU Undergraduate Biology hosted our 2008 Graduation Recognition Ceremony in the large lecture room of Budig Hall, which was well attended by our seniors and their families, and included an exciting surprise visit by Baby Jay! The ceremony was followed by an outdoor reception that gave our graduates and their families a chance to visit with our Biological Sciences faculty, staff, and teaching assistants.

Five Awards and Scholarship recipients were recognized during our Graduation Recognition Ceremony: Leah M. Meier (The Erma Reed Peterson Scholarship), Philip R. Adam (The Lance S. Foster Outstanding Junior in Biology Award), Elspeth Pearce (The Pauline Kimball Prize for an Outstanding Woman Senior in Biology), Philip R. Adam (The Del and Carol Shankel Biomedical Scholarship), and Nan Wang (The Paul A. Kitos Award for Excellence in Undergraduate Biochemical Research).

Also recognized at our Graduation Recognition Ceremony were all six seniors from our Biology Honors Symposium: Fikri Birey plans to pursue a Ph.D. in genetics; Kyle Hesed will attend graduate school in biology at the University of Maryland; Nasheena Jiwa plans to attend medical school; Elspeth K. Pearce will attend graduate school after research experience at the Stowers Institute in Kansas City; Ryan A. Townley plans to attend medical school; and Anne L. Vezeau is currently completing an additional degree in Spanish. In addition, five of our alumni-funded BioScholars entered the ranks of KUUB alumni by graduating in 2008: Fikri Birey, Jia Yin Feng, John Deacon Jones, Elspeth Pearce, and Eman Shaiwani; all received continuous BioScholars support throughout their KU careers.

In addition, five Graduate Teaching Assistants received awards for teaching excellence at the Graduation Recognition Ceremony. GTAs receiving awards were: Christina Terry (Robert H. Ammar Graduate Teaching Award (Microbiology), Debra Finch (Kenneth B. Armitage Award for Excellence in Teaching, Principles of Biology Laboratory), Ichie Osaka (Michael S. Gaines Award for Excellence in Teaching, Principles of Biology Laboratory), Sudharsan Parthasarathy (Richard H. Himes Graduate Teaching Assistant Award), and Tara Marriage (Sally K. Frost Mason and Kenneth A. Mason Award for Excellence in Teaching Undergraduate Biology Core Laboratory).
"EEB meets the Future by Building on the Past: Strategic Planning Reveals New Themes and Directions"

The Department of Ecology & Evolutionary Biology (EEB) is building on its past and planning for the future. Alumni of EEB and its related programs are well aware of our historical successes; the purpose of this message is to describe some of the changes that have been implemented and plans that have been developed in the past year. In addition to the reorganization of biological sciences at KU discussed elsewhere in this BioHawk edition, EEB has modified its profile and organization to take advantage of its enduring and emerging strengths. Just as life on Earth evolves, our department must adapt to the changes in the world of science and strive to remain at the forefront of our disciplines.

EEB originated in 1998 when the departments of Botany and Systematics & Ecology merged. In 2000, the Department of Entomology was added to an already large department. At that time, each of the 40 faculty members in EEB chose membership in one of four “Programs”—“Ecology and Population Biology,” “Entomology,” “Plant Biology,” or “Systematics, Biodiversity, and Macroevolution.” The primary roles of these intra-departmental programs were to (1) determine the hiring priorities for the future of EEB, and (2) provide opportunities for interaction among faculty members and graduate students with common interests and research agendas.

These programs eased the union of a cluster of small, discipline-centered departments into an integrated, multidisciplinary academic unit. But now, a decade after the origin of EEB, it is clear that these four historically-based programmatic subunits no longer position KU-EEB to meet the contemporary interests and demands of its faculty and graduate students. This view was reiterated in a report prepared by four extramural scientists who reviewed the Department in 2007.

One of the Department’s primary goals for the past year was to ensure that each and every EEB faculty member had a hand in charting the future of the department. To accomplish this, small discussion groups were formed to engage all faculty members in developing new departmental bylaws, revising procedures for evaluation and mentoring of faculty, improving our graduate education program, and restructuring the department. As a result, we have identified three broad and overlapping research and graduate education themes that characterize our departmental mission. “Biodiversity & Macroevolution” captures our strength in systematics, paleobiology, biodiversity informatics, and the reconstruction of evolutionary history. “Ecology and Global Change Biology” recognizes our focus on population ecology, aquatic biology, physiological ecology, and our emerging prominence in global change biology. “Evolutionary Mechanisms” features studies of the processes that result in the origins of species, characteristics, behaviors, and genetic variation, and emphasizes that KU-EEB faculty members develop and apply innovative theoretical and statistical approaches. Faculty members may align themselves with one or more of these themes, which are inclusive and interactive foci for research and graduate education rather than exclusive domains.

This new profile yields novel opportunities for positioning our departmental activities to meet the challenges of conducting creative research and of training the next generation of scholars. Building on an excellent foundation, we are currently crafting a strategic plan designed to propel KU-EEB forward into the increasingly competitive scientific arena.
Data demonstrate that EEB has established a solid foundation of success. In 2007, our faculty published more than 170 refereed papers and our graduate students authored more than 70! We collectively contributed to attracting more than $23 million of external funds that were used to conduct research during the past year. These accomplishments helped to place EEB as the 4th-ranked department at KU in terms of the number of faculty members who have external support and 8th in total number of grants. Together with our colleagues in the Department of Molecular Biosciences, the Ph.D. program in the Biological Sciences at KU is ranked 30th among public institutions by US News and World Report. As good as these numbers are, we are continually striving for improvement and greater success, and challenging ourselves to make the discoveries that will help to understand better the biology of organisms, from genes to ecosystems.

In addition to our collective accomplishments, individuals in EEB have made significant achievements since this time last year. Joy Ward received a highly competitive CAREER award from the National Science Foundation to support her research on global change. Edith Taylor was honored as one of KU’s “Women of Distinction” and featured on a calendar recognizing the accomplishments of those selected. Michael Engel was awarded the Charles Schuchert Award by the Paleontological Society. This puts him in such rarified company as Stephen J. Gould, Niles Eldridge, Philip Gingerich, Andrew Knoll, Peter Crane, and our own Bruce Lieberman. Jorge Soberón was invited to speak at a National Academy of Sciences Arthur M. Sackler Colloquium on Biogeography, Changing Climates, and Niche Evolution. These colloquia are organized to address a forefront scientific topic of broad interest, usually cutting across two or more traditional disciplines. Sharon Billings and Val Smith received funding to contribute as part of a team working on innovative ways to generate energy called, “Feedstock to Tailpipe,” using manure to stimulate the growth of algae that are then transformed into fuel. Craig Martin was awarded his second H.O.P.E. award for outstanding teaching. KU alumna Mary Dawson, now Curator Emeritus at the Carnegie Museum of Natural History, received a KU College of Liberal Arts and Sciences Alumni Distinguished Achievement Award. Dawson is an international authority on vertebrate paleontology and her research focuses on the origins of rodents and lagomorphs. In the spring, we honored Emeritus Professor Ken Armitage, dedicated a new education building at the University of Kansas Field Station and Ecological Reserves to him and his wife Katie, and initiated an Armitage Ecology Lecture series, which will be supported by a recently established endowment fund (contributions from interested alumni would be gratefully accepted). In October, we celebrated a remarkable milestone. Emeritus Professor Charles Michener turned 90, and to properly mark the occasion, former KU entomologists from far and wide visited the campus. Dr. Michener joined our faculty in 1948, therefore having devoted 60 years to the study of entomology at KU. In addition to recognizing the accomplishments of Dr. Michener, we also delighted in the 56 years that Emeritus Professor George Byers has been on the KU faculty, the 39 years of Professor Orley (Chip) Taylor, and the 36 years of Professor Rudolf Jander, thus totaling to an impressive 191 years of helping to build KU entomology into the major national and international program that it is today!

During the past year, our graduate students excelled as well. Andrea Crowther, a student with Daphne Fautin, was named a recipient of the KU University Women's Club scholarship, as well as fellowships from the American Museum of Natural History and the Smithsonian Institution. Jeff Cole, working with Jennifer Gleason and Michael Greenfield, was awarded first place in the student paper competition at the annual meeting of the Central States Entomological Society. Cathy Collins, a student with Bryan Foster, received a highly competitive KU Dissertation Fellowship. Matt Davis, working with Edward Wiley, received a Deep Fin Student Exchange Program grant. Jake Esselstyn, a student with Robert Timm and Rafe Brown, received a prestigious fellowship from the American Society of Mammalogists, while Sean Maher, working with Town Peterson and Bob Timm received a Grant-in-Aid of research from the same society. Cameron Siler, a student with Rafe Brown, and Patty Ryberg, a student of Edith Taylor, both received highly competitive Doctoral Dissertation Improvement Grants from the National Science Foundation. Cameron also received a prestigious Fulbright Fellowship.

Several faculty members in EEB contributed to the successful receipt of an Integrative Graduate Education and Research Traineeship (IGERT) focusing on both scientific and social aspects of global climate change. This IGERT represents an exciting and unique interdisciplinary synthesis of ideas and research agendas and it will support graduate education and research.
We are pleased to welcome three new faculty members to KU, all of whom were hired through successful searches conducted in the past year. Assistant Professor **Ford Ballantyne**, was most recently conducting postdoctoral research at Princeton University, and received his Ph.D. from the University of New Mexico. Ford is interested in understanding repeated patterns we see in nature. He studies changes in abundance, community structure, and ecosystem function across space and through time. Assistant Professor **Justin Blumenstiel** received his Ph.D. from Harvard University, and came to KU after his postdoctoral position at the Stowers Institute. Justin is interested in understanding how both genetic and epigenetic systems evolve. Working with species of *Drosophila*, the fruit fly, he focuses on the challenges of sexual reproduction, specifically addressing such questions as: What are the mechanisms underlying changes in the rate of recombination? Are these changes driven by natural selection or drift? Professor **Jorge Soberón** received his Ph.D. from the University of London and his interests lie in the description and modeling of biodiversity patterns at a geographical scale. This includes understanding the causes of species distributions like fundamental niches, migration, and evolution. With the addition of these faculty members, EEB has increased to 42 faculty members, and is the largest unit in the College of Liberal Arts and Sciences.

Short articles such as this can only scratch the surface of the many activities and advances that have occurred over the past year in the Department of Ecology and Evolutionary Biology. All alumni are encouraged to visit and see first hand the progress we have made and the exciting future we are developing. With an eye to greater opportunities in interdisciplinary activities and graduate student training, and through the development of a strategic plan that enhances our research and graduate education programs, we are looking toward a bright future that will benefit all members of our department and make our alumni proud.

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**KU Women of Distinction 08|09**

*Edith Taylor, Ph.D.*

Professor, Ecology & Evolutionary Biology

Editor, Natural History Museum and Biodiversity Research Center

Curtis Weihofen, Department of Biology

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*Dr. Charles Michener, Dr. George Byers, Dr. Orley (Chip) Taylor, and Dr. Rudolf Jander, total to an impressive 191 years of service.*

**Emeritus Professor Ken Armitage, with his wife Katie, were honored with a dedication of a new education center at the University of Kansas Field Station and Ecological Reserves.**

**Val Smith (left) and Sharon Billings (above) are part of a team “Feedstock to Tailpipe.”**
Did you know that KU is the home of the reigning CASP champion? Yang Zhang, who holds a joint appointment in the Department of Molecular Biosciences and the Bioinformatics Program, is also leading this year’s competition and is aiming to become the first ever two-time CASP champion.

Every other year, more than a hundred research teams, from universities around the world, compete in the year-long CASP competition to determine who can best predict a protein’s three-dimensional shape, armed only with a bank of computers and the protein’s amino acid sequence. That’s like trying to predict the locations of 100 five-year-old boys in a McDonald’s Playland, armed only with their heights and shoe sizes. While the exact location of the boys is information most parents can do without, knowing a protein’s exact shape is important to researchers who want to understand how proteins work as well as to researchers and pharmaceutical companies who want to design drugs that “fix” proteins that are not working properly due to disease or infection. Traditional, non-computer based, methods of protein structure prediction are simply too expensive (several hundred thousand dollars per protein) and slow (a year or two of work for one highly trained researcher) to keep up with the ever growing number of known protein sequences, each a potential drug target. By contrast, Yang’s work holds the promise of solving any protein’s structure in a matter of minutes!

The Department of Molecular Biosciences contribution to the war on disease is not limited to solving the structure of proteins, but also includes efforts to identify those proteins (and corresponding genes) that are targets—e.g., through mutation, infection, and/or environmental insults—of disease. Stuart Macdonald, who joined our faculty in 2006, is leading this charge by developing sensitive genetic tools to understand the genetic basis of complex traits in a model system, information which is applicable to the understanding of variation in disease risk, and drug response in human populations. Stuart also deserves champion status, having just received one of the largest National Institutes of Health grants (nearly 2.5 million dollars for 5 years) ever awarded to a Molecular Biosciences faculty member.

In addition to its war on disease, the Department of Molecular Biosciences is deeply committed to giving our students the best possible education, equipping them to be the science champions of tomorrow. This past year, Kristi Nuefeld became the Department’s eighth winner of the prestigious Kemper award for excellence in teaching. We are also continuing our efforts to add more honor courses to our curriculum and are near final approval on the establishment of a new PhD degree program in bioinformatics. Through the efforts of Jim Orr, the Department is also making a strong contribution to the university-wide effort to increase student diversity in the sciences. Jim serves as the Director of the KU Office for Diversity in Science Training and is the principal investigator on three grants from the National Institutes of Health that provide research support for minority students working here or at the Haskell Indian Nations University campus. Under Jim’s leadership, this program has grown to support the research of more than 50 minority students annually.

In closing, I would like to extend deepest thanks to all of our alumni, whose contributions are invaluable to our continuous efforts to improve the Department.
The enormously generous contributions of Dr. Irving Johnson came to fruition this fall with the arrival on campus of Berl Oakley, the first Irving S. Johnson Distinguished Professor of Molecular Biology. Dr. Oakley comes to our Department from Ohio State University, where he established himself as a world leader in the study of the microtubule cytoskeleton and its role in cell division, cell shape change, and cell motility. His new lab, on the 7th floor of Haworth, is nothing short of spectacular and we hope that Dr. Johnson gets a chance to visit it in the near future.

Deepest thanks also go to Larry Draper and Erik Floor, who retired this past year after long and distinguished careers as research scientist and teachers. Larry and Erik have both been granted Emeritus Professor status and we hope they remain active on campus. Finally, I would like to extend thanks to Kathy Suprenant who stepped down as departmental chairperson this past summer after four excellent years of service. The department reached unprecedented levels of achievements in teaching, service and research under Kathy’s leadership. I am committed to build upon her efforts and make MB an even better Department in the future.

Here are some highlights from our faculty. Roberto De Guzman received his first major research grant from the NIH to study proteins involved in bacterial pathogenesis by nuclear magnetic resonance spectroscopy. Chris Gamblin published papers in Neurobiology of Disease and the Journal of Alzheimer’s Disease and presented talks at the Universidad Central del Caribe in San Juan, Puerto Rico, the University of Alabama at Birmingham, and Iowa State University. Audrey Lamb presented her research at the Enzymes, Coenzymes and Metabolic Pathways Gordon Research Conference in July. She received the IDEAS Network of Biochemical Research Excellence (K-INBRE) Faculty Scholar Award, and acquired a Pilot Project grant from the Kansas Masonic Cancer Research Institute. Liang Tang received a pilot project grant from NIH COBRE and gave a talk at UMKC. He has launched a research project about a giant enzyme assembly responsible for cellulose biosynthesis and plant cell wall metabolism.

We are particularly proud of the fact that Yang Zhang was recently awarded a 2008 Alfred P. Sloan Fellowship. He successfully acquired two major research grants from NIH and NSF and, as mentioned above, is poised to once again win the world-wide CASP8 competition. Wonpil Im had another productive year. He published 8 papers in several journals including PRL and JACS. He was invited to give a talk at a Gordon Research Conference. The group leader of Bioinformatics, Ilya Vakser successfully renewed his NIH R01 grant, published eight papers, hosted the 4th International Conference on Modeling of Protein Interactions, and successfully participated in the community-wide Critical Assessment of Predicted Interactions experiment.

Senior member, Krzysztof Kuczera presented his work on peptide simulations at conferences in Ventura, CA, Minneapolis, MN and Torun, Poland. He received a Kemper Teaching Award and Graduate Student Recognition Award from KU. Mark Richter took his sabbatical leave and went to Brazil for his collaboration research. Finally, Fusao Takusagawa was able to publish two papers about enzyme catalysis and was invited to give talks at two international meetings (Japanese Biochemistry Society Meeting in December 2007 and the GST Conference in Uppsala Sweden in August 2008).

Research in cell biology and genetics has moved forward rapidly this year at KU. As mentioned above, Stuart Macdonald looks at the natural variations within a single gene that occurs within a species, the popular lab organism Drosophila. Natural variations in gene sequences occur in all of us, and create subtle differences that determine our susceptibility to cancer, heart disease, and infections. Yet the natural amount of variation within our genes is not really well known for any animal. Dr. Macdonald’s research is filling in a crucial gap in our basic knowledge of the genetics of disease.

Another popular organism for genetics studies, the roundworm C. elegans, was the subject of the Nobel Prize for Physiology and Medicine this year. It was the first organism in which researchers demonstrated the ability to watch a protein function within living cells by using genetic methods to attach that protein to a naturally fluorescent protein (“GFP”). Molecular Biosciences is fortunate to have five labs studying these lovely creatures: Brian Ackley, Erik Lundquist, Kathy Suprenant, Lisa Timmons, and myself. We all can attest to the usefulness of GFP for studying proteins, and the beauty of animals with tiny glowing cells. Lundquist has had a particularly productive year studying the development of the nervous system in C. elegans: He published 3 papers detailing the activity and control of small GTP-binding proteins, which activate the cytoskeleton in growing nerve cells to form connections to muscles and to other neurons. Multiple proteins act redundantly to make sure that the connections are precise, so using genetics to tease out the function of these activators is a difficult task. Graduate students from Lundquist’s lab were authors on these papers, including Jamie Chapman, Rafael Demarco, and Hua Li. Jamie Chapman won the Twomey Award for her work. Dr. Lundquist was on sabbatical for fall of 2008 and did not teach Biology of Development.
Lundquist gave a talk this year at the Cold Spring Harbor Laboratory, and is a regular member of the NIH Study Section on to evaluate the medical merit of proposed research to understand how the cytoskeleton of nerve cells function.

Kristi Neufeld has also had a good year. As mentioned above, she became the latest member of Molecular Biosciences to win a W.T. Kemper Fellowship for Teaching Excellence. Her course, which she offers each fall together with Yoshiaki Azuma, “The Molecular Biology of Cancer,” is one of the most popular upper-level biology courses at KU. Neufeld and Azuma also collaborated on research this year, publishing their research findings on how the tumor suppressor protein APC (adenomatous polyposis coli, say it 3 times fast!) interacts with proteins that regulate each cell’s decision on when to begin mitosis.

Best of all, the cell biology group is delighted to welcome our new addition to the Molecular Biosciences Department, Berl Oakley, the Irving S. Johnson Distinguished Professor of Cell Biology. Prof. Oakley’s 1990 paper on the discovery and role of the gamma-tubulin protein in the formation of the spindle pole body during mitosis was chosen as one of just 9 landmark papers on the cytoskeleton from the last 40 years by the American Society of Cell Biology. Berl and Elizabeth Oakley are experts in the genetics, cell biology, and metabolism of the fungus (mold) Aspergillus nidulans, and have pushed forward the investigation of this organism as a genetic model, including the complete sequencing of its genome in 2006. We are proud to welcome Berl and Elizabeth to Lawrence and their new home on the remodeled 7th floor of Haworth Hall, and look forward to many productive collaborations and discussions.

Stephen Benedict
Microbiology

This past year marked a severe depletion of Microbiologists at KU. First, we congratulate our long-standing and much respected colleague Professor Larry Draper who retired this year. Draper will remain active at KU to help at the advising center and engage in some light teaching duties but we will lose his tireless and outstanding teaching and his guidance of students. Similarly, our much-respected colleague Professor Jack Brown is entering phased retirement where he will teach half time and participate in reduced activities. We will miss Jack’s outstanding teaching and his very strong interactions with the students. This year we also learned that three of our research active faculty members will be leaving. Vladimir Yamshchikov has moved to the Southern Research Institute in Alabama, where he is Director of the Department of Infectious Disease Research. Bill and Wendy Picking will leave in summer, 2009. They were recruited to Oklahoma State University where Bill will become chair of the Department of Microbiology. This was a bittersweet series of events because we wish our colleagues well in their new endeavors even though we are depleted of their many contributions to our teaching and research programs here at KU.

The microbiology faculty was very productive during the past year, and provided extracurricular research projects for sixteen undergraduate scientists. Congratulations are due to each faculty member and their undergraduate students: Picking (2), Hefty (3), Egan (1), Davido (3), Tang (2) and Benedict (5). Four research manuscripts with undergraduates as coauthors were published or submitted from these labs (Stetler, Picking, Benedict), and several of our research presentations at local or national scientific meetings featured the work of undergraduate students. Such opportunities are available for undergraduates at KU because of our strong research emphasis.

The Microbiology graduate students were very successful as well. Abby Dotson (Benedict) won the Hirata Research award. Kelli Cool (Benedict) won the William Arnold award and continues her national P.E.O. graduate fellowship. Jeff Skredenske (Egan) won the Cassandra Ritter award and a Paretsky Travel award for presentation at a scientific meeting. Lingling Zhang (Picking) also won a Cassandra Ritter award and a Paretsky Travel award. Collectively the department continues to train thirteen outstanding graduate students in Microbiology and Egan trains a postdoctoral fellow. Picking graduated a PhD student this year. The department accepted 10 new graduate students this year who expressed an interest in studying microbiology for their graduate degree. The Microbiology faculty published or submitted a total of eleven scientific papers, Picking (4), Egan (4), Davido (2) and Benedict (1) and submitted two patents (Davido, Benedict). All of these involved participation of graduate students. Egan just began serving on the editorial board of the Journal of Bacteriology and Benedict serves on the editorial board of The Open Pathology Journal. Bill and Wendy Picking organized the Great Plains Infectious Disease meeting at KU for the 7th year. The meeting was attended by 90 scientists, from several academic institutions and companies, representing 4 states.

Microbiology teaching continues at a high level and Jack Brown received the “Favorite Professor Award” from the Biology Graduating Seniors making this 7 of 8 years that this award has gone to a microbiologist. Matthew Buechner is a finalist for the H.O.P.E. award this year and Steve Benedict was a finalist for the Del Shankel Teaching Excellence Award given by student athletes.

Brian Ackley
Neurosciences Group

Change is ever our constant as this year we have said farewell to Erik Floor, who retired from the Department this summer. John Karanicolas has joined our group this
The brain. The most complex computer ever developed. It has the ability to function faster and more efficiently than even the world’s best computer. But just like computers, the brain is prone to glitches, bugs and viruses that cause anomalies such as mental and physical handicaps.

The brain has 10 billion cells. Each cell has 10,000 connections. That’s 100 trillion total connections. Understanding those connections and how they are made is at the center of research being performed by a number of University of Kansas professors from the Department of Molecular Biosciences.

The list of notable researchers, including the Dean of the School of Liberal Arts and Sciences Joe Steinmetz, is long and distinguished, said Acting Chair of Molecular Biosciences, Bob Cohen.

“It’s an impressive group of people covering a lot of different aspects of brain research,” he said. “For a department our size, we have a lot of breadth and depth.”

One can say there’s a lot of brain power at work at KU.

From Jellyfish to Nobel Prize
Any discussion of the latest in brain research can’t be started without first highlighting the awarding of the 2008 Nobel Prize in Chemistry to Osamu Shimomura, Martin Chalfie and Roger Y. Tsien. The award was for discovery and use of the jellyfish’s green fluorescent protein (GFP) to illuminate and study life’s smallest building block – the cell. The Royal Swedish Academy of Sciences, the body that awards the Nobel Prize, likens the GFP discovery to that of the microscope. Scientists are now able to see what was invisible just decades ago.

The use of GFP has seemed to be the final number in a complex combination unlocking a massive dossier of cutting edge research.

“The discovery and use of GFP for cell illumination really is the beginning of a new era of brain research,” said Cohen. “For the first time, we can finally see what we are studying.”

Glow little glow worm
One of those notable researchers is Erik Lundquist, Associate Professor of Molecular Biosciences. Like a biological electrician, Lundquist is shining a GFP light on the brain’s wiring by studying the nematode worm C. elegans, with just its 302 neurons.

“The worm has the same genes and proteins that vertebrates do,” Lundquist explained. “So, if we know what they are doing in the worm, we know what they are doing in humans.”

Through funding from the National Institutes of Health and the National Science Foundation, Lundquist’s lab is focusing on two major initiatives – cell migration and axon pathfinding. Even organizations such as the March of Dimes make funds available for this type of research. For things to work properly in a vertebrate’s nervous system, nerve cells have to migrate, explained Lundquist. “Their final position is not where they started,” he said. It’s this movement, like those of frontier people across the plains more than a century ago, that Lundquist is researching and mapping. He points out that if the migration doesn’t happen or happens poorly, then the affect could be those anomalies such as mental retardation disorders.

Those bumps and valleys in the brain are caused by the migration patterns of cells. But when there is no migration, the brain doesn’t form properly and has a much smoother surface. Lissencephaly, or “smooth brain” in Greek, is what these mental retardation disorders are commonly referred to, Lundquist said. Brain organization problems are also seen in those with autism or even Down’s syndrome.
But merely tracking the path is not the only outcome, Lundquist noted. By tracking he can also see how they interact with each other.

“Many diseases are caused by multiple genetic disorders,” he said. “Understanding how multiple genes interact with each other is important to understanding the disease. The more we know, the better it will be for therapeutic intervention,” Lundquist said. “We can better understand the pathway that might contain targets for known drugs.”

Axon pathfinding is like using a divining rod to track the path water takes underground from its source. Motor neurons in the spinal cord send cellular wires – or axons – to other areas of the central nervous system. By tracking the axon movement from the spinal cord, Lundquist can map how they get to where they are going. By knowing this path, scientists can possibly recreate that path when the motor neuron has gone awry or has been damaged in a spinal cord injury, for example.

Form follows function
It’s been less than a generation from the time GFP hit mainstream science to now. So the research KU scientists are doing is inevitably breaking new ground. That’s the case with Assistant Professor Brian Ackley’s lab, which is studying the interaction between neurons and their environment.

“We continue to be amazed at our ability to visualize the proteins at synapses as they develop,” Ackley said. “With GFP, we have an unlimited palette to address the questions we want.”

Ackley’s research addresses why certain synapses are defective. The defects he sees in his lab are similar to the synaptic defects suffered by those with Muscular Dystrophy and Alzheimer’s. In fact, the initial research was funded by the Muscular Dystrophy Association.

“We have been looking for new mutations that suppress the synapse defects,” Ackley explained, “because these molecules could lead to potential new therapies for MD patients.”

As a geneticist, Ackley is interested in how the connections are made in the brain. He is then able to alter those connections and impact potential development. He likens his lab to that of a crime scene investigator trying to piece together a seemingly unconnected string of evidence. Once Ackley uncovers during his interrogation what protein is talking to another protein, he can then script that dialogue.

He is taking experiments that were merely assumptions prior to the use of GFP and actually proving or disproving them. “This really is a time of gene discovery,” he said. “We are adding new vocabulary words to the discussion.”

The Next Frontier
“We provide the ideas of basic science,” Lundquist said. “We provide the basic underpinning to clinical scientists at the medical centers. The researchers at KU are interacting with a larger scientific community. The research is contributing to larger scale programs.”

The next frontier for brain research could bring another quantum leap, Cohen said. “Our next level of questions can be three dimensional in nature, due to better imaging techniques.”

Lundquist noted that discoveries of new therapies and different uses for known drugs might be less than a decade away.

The research of the future will incorporate a multi-disciplinary approach, predicted Cohen. That will mean bioscientists, computer scientists, chemists and engineers all working together to unlock the full power of the brain.

The University will continue to work hard to recruit and retain the brightest the scientific community has to offer. Lundquist points out many strides have been made in that area as well as in efforts to equip him and his colleagues with the tools necessary to bridge the scientific gap. In addition, infrastructure upgrades will continue to be needed in order to compete on tomorrow’s scientific landscape.

“KU does an excellent job in providing the core facilities to enable us to focus on the science,” Ackley said.

Nature’s Computer – the brain
While scientists can identify many of the proteins and genes involved in sensory perception, such as sight and smell, they do not really understand what the brain does with this information.

Scientists are asking the questions about how the brain stores the information, such that it becomes part of permanent memory. For instance, why does a person remember what a rotten egg smells like? Related to that, smells, sights, and other stored sensory information can also be linked together to provide complex memories. A person may not only remember the smell of a certain perfume but associate a person and a memory to that smell. Think of grandma’s cupcakes fresh from the oven. Now, what memories are associated with that smell?

“Presumably, all of that information in stored in those 100 trillion connections, but mapping those connections will not tell us ‘how,’ Cohen said. “Frankly, it is not clear how we will learn the ‘how’, but a multidisciplinary approach is a must.”

And this learning translates to a myriad of other disciplines.

As scientists learn about how the brain functions, perhaps they can incorporate its abilities to handle complex and multiple data sets into the development of advanced technologies. For instance, can the principles that govern learning in humans be sufficiently well understood as to allow scientists to translate them into computer language, thus creating the next generation of machines that not only compute, but learn?

Then perhaps those “learning machines”, with their superior computing capabilities, can help scientists understand how the brain works.

And what they learn can then be used to build something that can rival what nature has to offer – the human brain.

BIOHAWK 2008 11
Andrea L. Crowther  
Mentor: Dr. Daphne Fautin

I am a third year graduate student studying with Dr. Daphne Fautin in the Department of Ecology and Evolutionary Biology. I received my Bachelor of Science in Zoology and Marine Biology from the University of Queensland in my home town of Brisbane, Australia. I also received an Honors degree, in which my research project involved classifying and identifying a species of tube-anemone found in Moreton Bay (near the university). This process of classifying and identifying species is called taxonomy, which is a field of study that interests me. After receiving my honors degree, I worked at the Queensland Museum in the Sessile Marine Invertebrates division where I collected and identified sponges, and finally at the Museum of Tropical Queensland on a project entitled “Sea anemones of Australia.” While working on this project, I met my current doctoral advisor who is based here at KU. In deciding to take my research and knowledge of sea anemones further by embarking on a doctoral degree, the best choice for me was to work with Dr. Fautin here at KU.

My dissertation research involves a group of sea anemones that have similar morphology and investigating whether these anemones are evolutionarily closely related. I study shallow, tropical sea anemones that possess branched outgrowths and spherical defensive structures. These anemones form mutualistic relationships with zooxanthellae, which photosynthesize and provide the anemone with sugars. It is inferred that the outgrowths serve to increase surface area and thereby to accommodate more zooxanthellae. Associated with branched outgrowths are spheres composed largely of stinging capsules that can sting even humans.

I will use methods of taxonomy and phylogenetics to sort out whether the similarity in morphology is due to common ancestry or may be a result of species living in similar environmental niches (convergent evolution). To do this, I need to investigate the fine details of the morphology, using specimens in museum collections and ones that I will collect from the field. Being able to determine whether anemones possessing branched outgrowths and spherical defensive structures are most closely related to each other, rather than any other anemones, will provide insight into how many times this morphology may have evolved. The methods that I am learning here at KU to investigate questions pertinent to evolutionary biology will be important for the rest of career.

Cameron Siler  
Mentor: Dr. Rafe Brown

My first research experience was as an undergraduate at the University of Texas at Austin. After completing my Bachelor degree in Texas I was awarded a Fulbright Fellowship to spend ten months in the Philippines conducting biodiversity and conservation research within the central Philippine islands. My experience overseas was incredible, and upon my return to the U.S. I continued this research in a Ph.D. program at The University of Kansas with Dr. Rafe Brown. Over the last four years I have made seven additional trips to the Philippines to conduct biodiversity surveys as part of a long term collaborative project between The University of Kansas and the Philippine government. Our goal is to work towards a more complete understanding of the diversity of vertebrate life within the Philippines.

My dissertation work as a graduate student will investigate the process of limb reduction and loss in lizards from Southeast Asia. Limb loss has been documented to occur in numerous groups of lizards from around the world; however, only four groups of lizards include species showing all degrees of limb loss, from fully limbed to limbless body forms. One of these lizard groups occurs in the Philippines and Borneo, and will be the focus of my dissertation study. Recently, I was able to secure funding from the National Science Foundation to enhance this dissertation research.

At KU I have been fortunate to be involved in the Madison and Lila Self Graduate Fellowship Program. The program has provided me with opportunities to develop better skills in leadership, writing, and speaking, to name a few. I have been able to use many of these skills in the classroom, where I have spent time as a teaching assistant for an undergraduate genetics course.

Looking towards the future, I plan on pursuing a tenure track position at a university in the U.S., while expanding upon my biodiversity research work in Southeast Asia. Towards this goal, I will conduct nine months of research in 2009 in the Philippines as part of a Fulbright-Hayes Fellowship.
**Qianyi Luo**

Mentor: Dr. Audrey Lamb

Qianyi Luo is currently a graduate student in the Department of Molecular Biosciences at KU. She received her M.S. in Microbiology and Immunology from China Agricultural University, China in June 2003. Since August 2003, Qianyi joined the doctoral program at KU with Dr. Audrey L. Lamb where she is learning structural and functional analysis of enzymes associated with iron uptake from the opportunistic pathogen *Pseudomonas aeruginosa*.

*P. aeruginosa* is a ubiquitous bacterium and a dangerous opportunistic pathogen, which can cause infections in susceptible hosts, such as AIDS patients, cystic fibrosis (CF) patients, cancer patients, and burn patients. Isolated strains of *P. aeruginosa* have been found to be resistant to many commercially available antibiotics. Iron is an essential element for many bacteria, including *P. aeruginosa*. During infections, pathogenic bacteria must sequester iron from the host to support their metabolism. A common method used by these bacteria are activated by antigen they will increase in number by cell division, and differentiate into effector T cells that fight infection or memory T cells that are long lived in the body and quick to reactivate upon a second infection. Our lab studies how naïve T cells become activated and differentiate to effector and memory T cells in young individuals compared to older individuals.

In order for naïve T cells to become fully activated they need two stimulatory signals. Costimulatory molecules send a second signal into naïve T cells that follows stimulation of the T cell receptor (TCR) and greatly affects how naïve T cells activate and differentiate. Of the costimulatory molecules, CD28 and LFA-1 are the most characterized however our lab has shown that Intercellular Adhesion Molecule-1 (ICAM-1) can drive naïve CD4+ T cells to effector and memory phenotype. My project is to apply a tissue culture differentiation system to naïve CD4+ T cells from younger and older human subjects, and investigate differential expression of genes which are known to participate in T cell responses. We are asking whether the cells can differentiate to a memory subpopulation with equal efficacy in young and older subjects, and how this intermediate gene expression compares between naïve T cells from young and older subjects. We hope that our findings can suggest possible immunotherapies for older individuals that may lead to increased T cell activation and therefore could possibly be applied to effectiveness of vaccines and therapy of cancer.

Qianyi’s research is focused on the examination of the structures and the kinetic mechanisms of two enzymes involved in the production of salicylate for building the siderophore pyochelin in *P. aeruginosa*. Using x-ray crystallography, kinetic analyses, and mutagenesis, information required for rational drug design will be obtained.
I have been doing research with Dr. William Picking since March 2007. We are a bacterial pathogenesis lab focusing on the Gram-negative enteric organism Shigella flexneri. Shigella species are able to invade the human colonic epithelium using a Type III Secretion System (TTSS). The TTSS is analogous to a molecular needle and syringe and is used by the bacterium to inject effector proteins through the needle into the host cell to subvert normal cellular functions and promote entry of the organism into the target cell. The protein IpaD (invasion plasmid antigen D) docks constitutively at the tip of the surface exposed needle of the Shigella TTSS. My work has confirmed our lab’s hypothesis that IpaD serves as an environmental sensor for the TTSS by controlling the timing and sequence of secretion induction, an essential step in the infectious cycle of this organism. We have used a technique called fluorescence polarization to show that IpaD binds to a tagged form of deoxycholate (DOC), a bile salt commonly found in the human gastrointestinal tract. Another member of the lab further demonstrated that IpaD undergoes an important conformational change upon binding DOC. Together, these data support our model that IpaD binds to DOC which induces a conformational that allows a second protein called IpaB to move through the needle and dock at the tip through an interaction with IpaD. The presence of these two proteins at the bacterial surface has been confirmed using immuno-fluorescence microscopy in which antibodies specific to the surface-exposed proteins are used to visualize them on the bacterial surface.

Although we are a microbiology laboratory, we regularly employ techniques from other fields, especially biochemistry and biophysics. Using a variety of approaches to take on a problem is one of the greatest things I have learned from working with Dr. Picking. Having learned a variety of techniques will help me immensely in my future research.

Participation in undergraduate research has given me many incredible opportunities including fellowships, travel to regional and national meetings, and most importantly, practical laboratory research experience. This experience is truly invaluable and will give me an edge when applying for graduate schools. In my opinion, every undergraduate that is thinking about attending graduate school should seriously consider participating in research.

In the spring of 2008, I was offered my first research project by Dr. Mark Richter to crystallize ATP synthase subunit epsilon for my proposed Biochemistry Departmental Honors. My crystallization project has been conducted in Dr. Audrey Lamb’s lab specializing in protein-crystallization. Initially, I spent most of the time in Dr. Richter’s lab, under Dr. Phillip Gao’s direction, 1) reading literature on the effects of fusion-protein for crystallization, especially with maltose-binding protein as the large affinity tag; and 2) learning hands-on the protocols involving all steps from protein expression to purification to desalting. I then took the protein samples to Dr. Lamb’s lab and spent the rest of the time there, 1) reading McPherson’s Crystallization of Biological Macromolecules; and 2) undergraduate research associates’ direction, concentrating and screening proteins for crystallization with hanging drop diffusion.

The seven months of valuable research experience both substantiated my four-year lab trainings and exposed me to a new genre of state-of-the-art research equipment and associated techniques. As an undergraduate student, I had been treating my lab classes as the chief means to give me hands-on experience. However, at the initial stage of my first research, I realized that, for four years, I only learned the forms of scientific research but not yet treaded in its spirit. In schooling, my labs were counted by hours; but now, my research is measured in days, weeks, months, but, more importantly, by projects. After the first three months of adjustment, I have developed a feel for scientific research that is a distinct concept from conventional pedagogy.

2004 Shawnee Mission West H.S. graduate. I went to Johnson County Community College for three years (2004 fall to 2007 spring) for Emergency Medical Technician (EMT) certification, Honors Program, Pre-Medicine, Civic Honors Program (also known as Service-Learning) and Biotechnology Program. I then transferred to KU, originally planning on three years (2007 fall to 2010 spring) in Honors Program, Pre-Medicine, Biochemistry B.A./Chemistry Minor, and Air Force ROTC. When I began schooling at KU in the fall of 2007, I was also taking firefighter certification via KU Kansas Fire & Rescue Training Institute and related classes at Kansas City Kansas Community College. However, due to a back injury in the same semester, although having passed the written portion of the certification, I have not taken its practical portion.

After a year of military training as an AFROTC cadet, I was recently disqualified by the Air Force due to the back injury. Based on my observation of military casualties and my own experience as a trauma patient, I find a gap in modern medicine between keeping trauma patients alive and having them healed. Therefore, I am interested in becoming a surgeon doing research to develop and practice reconstructive/regenerative therapies for our service men and women and the society at large.

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Looking back at the Recognition Ceremony 2008

Jia Yin Feng, graduate and John Howieson Bioscholar recipient with her mother.

Dr. Rafe Brown (EEB) and Dr. Val Smith (Interim Director, KUUB).

Baby Jay attends the ceremony for the first time!

Recipients of GTA awards: Sudharsan Parthasarathy, Christina Terry, Ichie Osaka and Tara Marriage.

Elspeth Pearce, graduating senior and John Howieson Bioscholar recipient.

Dr. Chris Hauffer shakes an undergraduates hand.

Jia Yin Feng, graduate and John Howieson Bioscholar recipient with her mother.

Deacon Jones graduating senior and Haller-Silva Bioscholar recipient.

Dr. Daphne Fautin gives a speech.

Dr. Chris Haufler shakes an undergraduates hand.

Deacon Jones graduating senior and Haller-Silva Bioscholar recipient.

Dr. Deb Smith and Dr. Robert Hagen, faculty members of EEB meet with parents.
Science is as much about stretching the norms as it is about perfecting the process. So, it’s little wonder that Stuart Macdonald, in just his second year as a professor in the Molecular Biology Department at the University of Kansas, has excelled at both.

From the land of the Beatles to the inspiration for the Beach Boys and now to Lawrence, home of some of the country’s greatest independent bands. All along the way Macdonald has decided to “stretch the norm” and instead sports thrashing tunes from Slayer and Nine Inch Nails in his MP3 player.

“As a PhD student I was very ‘gothy,’” Macdonald admits now, indicating his current wardrobe of all black came at an early age. In fact, from the time he was 12 until he was 27, he didn’t cut his hair. Then, one hot California day while doing post-doctorate work at the University of California-Irvine, he just shaved it off. He kept to the electronic clippers because taking a blade and sporting the clean-shaven look “would have been extreme, even for me,” he said.

Showers to Surf

Macdonald grew up in Liverpool, England. He moved on to the prestigious Oxford University for his undergraduate and graduate studies and to the University College of London for post-doctoral work. That’s where fate and happenstance merged. He was in his first week when he saw a job posting on a popular Web server for science students. There he found an opening that would bring him to California. He sent an email to inquire.

“And within an hour I had an email back,” he said.

Because postdoctoral positions are funded differently in the UK – on a year-to-year basis – Macdonald completed his one year at the University College of London then arrived at University of California-Irvine for postdoctoral work. His only two other trips to the United States had been to North Carolina in the July heat and Michigan in two feet of snow in February. He was on to California, where after just a few months he started to reminisce about home and wonder, “When is it going to rain?”
A man for all seasons

After five years of sand, surf, and sun – and a lot of science – Macdonald accepted an assistant professorship at the University of Kansas. And he’s not wasting any time making a name for himself and the University. Macdonald recently was awarded a $2.5 million grant from the National Institutes for Health to conduct his genetic research. Macdonald’s lab is researching complex trait variation in genes. Many things are controlled by a single gene, such as cystic fibrosis. Other things, such as height, are impacted by multiple genes.

By studying the fruit fly, Macdonald is addressing questions about how many genes are involved in certain traits and diseases. In addition, in isolating the genes he’s also trying to isolate any environmental impacts that may cause traits to vary among individuals. Macdonald points out that many studies have mapped Quantitative Trait Locus (QTL) for complex human diseases; however few have pinpointed the actual disease loci. He is attempting to gain a general understanding of the molecular genetic basis of complex traits. Thus, he can gain insight into the sequence-level control of human disease risk. Since Macdonald is able to estimate the fraction of variations due to common alleles, he can determine the optimum strategy for identifying the genesis of the disease in humans.

Finnish fruit fly

Complex diseases are controlled by a large number of potentially interacting genetic and environmental factors. Each year millions of Americans are diagnosed with complex diseases such as diabetes, heart disease, Alzheimer’s, and various forms of cancer. If the precise genetic combination contributing to the disease could be characterized, the disease incidence might be predicted, and treatments could be modified on a case-by-case basis to halt disease progression.

The main aim of Macdonald’s lab is to develop an integrated framework for the genetic dissection of complex traits in a model organism – the fruit fly. So Macdonald has set out to develop a pair of special laboratory colonies of fruit flies. Through 50 generations of controlled breeding, flies within each of these “synthetic populations” can trace their beginnings to eight, genetically different founding strains of flies. There aren’t many branches in the family tree of these fruit flies, and the ancestral relationships of the genes are easily inferred, giving Macdonald the control and the power to conduct his genetic studies.

Because Macdonald is also able to closely control both the genetic and the environmental impacts to the fruit flies, he likens the population on the human level to that of Finland. Finland’s population is fairly isolated both in terms of inserting other genetic types as well as unique environmental situations. Genetic studies on the Finnish population led to major inroads in our understanding of human disease, and Macdonald is confident the same will be true of his fly populations.

“Stuart is on the cutting edge in our department,” said Erik Lundquist, associate professor and a Macdonald colleague. “He’s addressing questions in genetics we couldn’t address five years ago. And what he is doing has strong multi-genetic components.” Thus impacting much of the other research being conducted on the hill.

Adjusting to the classroom

For Macdonald, the inclusion of teaching duties along with his research has taken some getting used to. But Lundquist indicated it appears to have been a seamless transition.

“Stuart came in at such a high level,” Lundquist said. “He’s naturally gifted and intuitive. He’s able to break things down and make it digestible for others.”

Working with students has been just as rewarding for Macdonald as his research. “The students really surprise you with how much they do know,” he said. “Ultimately, the teaching is pretty rewarding.” It’s apparent to his colleagues that Macdonald is excelling in the classroom as well as the laboratory.

“We were really fortunate to get Stuart to come to the University,” Lundquist said. “He gives us all a new perspective on how to go about looking at our science.”

Even if that perspective comes from someone clad in a “death metal” concert t-shirt with an English accent. ☠

photos courtesy of Dr. Stuart Macdonald
In 1969, the Division of Biological Sciences was formed as an administrative unit to integrate five different departments (Biochemistry, Botany, Entomology, Physiology & Cell Biology, and Systematics & Ecology) and coordinate aspects of budgeting, use of common research resources and infrastructure, teaching of undergraduate courses, allocation of graduate teaching assistants, and planning for faculty hiring. In 1996, the Department of Microbiology joined the Division and became a sixth departmental member.

At the height of its complexity as an administrative unit, serving six different departments, departmental mergers began reducing the number of units. The Department of Biochemistry merged with the Department of Physiology & Cell Biology in 1997 to form the Department of Biochemistry & Molecular Biology. In 1998, Microbiology joined that amalgamated unit to initiate the Department of Molecular Biosciences (MB). In the same year, the Department of Botany merged with the Department of Systematics & Ecology to become the Department of Ecology & Evolutionary Biology (EEB). In 2000, the Department of Entomology merged with EEB. Since that time, two departments and the associated Undergraduate Biology Program, that coordinates all of the undergraduate degrees and draws on faculty talent in the two large departments, have represented the KU Biological Sciences. Because the two departments recruited their own faculty members and maintained largely separate budgets, the Division became more of a staff management entity than one for establishing policy or coordinated graduate programs.

During the fall 2007 semester, discussions with Dean Joseph Steinmetz resulted in the decision to dissolve the Division as an administrative entity and as of 1 July 2008, the Biological Sciences at KU are composed of three complementary and highly integrated academic units: the KU Undergraduate Biology Program (KUUB, directed by Val Smith); the Department of Ecology & Evolutionary Biology (EEB, chaired by Chris Haufler); and the Department of Molecular Biosciences (MB, chaired by Bob Cohen). Staff members were reassigned to each administrative unit and separate budgets were negotiated directly with the College. It is anticipated that this new structure will help us to enhance graduate teaching and research, while retaining the benefits of a unified and centralized Undergraduate Biology Program that allows our majors to move seamlessly among a dozen different degrees. EEB and MB also gained greater flexibility in setting department-specific goals, and in helping their faculty and graduate students succeed.
“Randy is a futurist. He is fascinated by what the world can look like in the future, decades out, and then working to make that vision a reality.”
- Former KU professor and current CSO of Genomic Health, Joff Baker

While his University of Kansas classmates poured over class notes and scientific journals, Randy Scott was reading a different kind of journal — The Wall Street Journal. So, when Scott took his doctorate to the business world, no one was surprised. Least of all his mentor at the time, former Division of Biological Sciences professor Joff Baker.

“When he was interested in biomedical science and technology per se, he was even more interested in the business/industrial possibilities offered by biomedical science and technology,” Baker said of Scott. “He has an absolutely great head for seeing and executing on opportunities in this realm.”

And those opportunities took him to California where he co-founded Incyte Genomics and later co-founded, Genomic Health, where he has been since 2000. Genomic Health is a life science company that conducts sophisticated genomic research which ultimately leads to individualized information on the likelihood of disease recurrence and response to certain types of therapy. Focusing on breast cancer, Genomic Health and its product Oncotype DX generate information that healthcare providers and patients can use in making treatment decisions.

“We founded the company with a focus on cancer because we feel there is an immediate opportunity to impact the quality of care for cancer patients,” Scott said. And that impact has reached tens of thousands of women who are now cancer survivors.

Science nerd

Scott, who grew up in small-town Kansas, described himself as the “typical science nerd” as a child. His first research was to analyze the water and plants from a nearby lake through his own microscope when he was still a pre-teen.

“The earliest I can remember I wanted to be a scientist,” Scott said. The experiments, research and unlimited possibilities, “fueled my imagination.”

Scott attended Emporia State University for his undergraduate studies in the mid-1970s. That’s where he encountered a professor that fueled his love for science. “I wasn’t a very good ‘book’ student,” Scott admitted. But a chemical engineering professor during Scott’s junior year got him to see science beyond the textbook and instead experience it – just like he did as a kid examining slides in his microscope.

After graduating from ESU, Scott moved to Lawrence to work on his graduate degree at KU. There, a roommate that moved with him from Emporia actually dropped out of KU, leaving Scott to cover the entire rent on his own. This led him to seek a position in one of the science labs where he met the man who became his thesis advisor – and eventual business partner.

In this lab, Scott and others worked on the proteus nexim protein. The research found the protein that blocked the extra enzymes that degrade tissue. Early on, researchers felt this was involved in cancer. They then could take this protein – and once purified – block tumor cell invasion.

“It was,” as Scott said, “an all or nothing project. And that’s when I got excited and intent on a career in the cancer field.”

Business side of science

As a member of the Biology Alumni Advisory Board, Scott continues to give back to the University community as well. He was awarded the Distinguished Alumni Award in 2006-07 from the College of Liberal Arts and Sciences. Scott sees his greatest value as instilling that entrepreneurial spirit into today’s student scientists. He has hosted events that bridge the gap between business, biology, engineering and computer sciences.

One event was the Bioentrepreneurship Symposium for undergraduates in biology, where he was the keynote speaker. Kathy Suprenant, professor in the MB department, said students were inspired by Scott’s discussion about his path from KU to founding Genomic Health.

“One of the most important take home messages that Randy repeated was learning from your failures,” Suprenant said. “Every successful entrepreneur has failed along the way and entrepreneurship as a career almost requires these cyclical learning experiences with the almost messianic ability to pick up and move on to the next great idea.”

From Oz to Ah-has

“Kansas is such a wonderful place to grow up,” Scott said. “I had a blast at KU.”

Scott is now having a blast leading Genomic Health into a new era of genetic medicine. His company is not only discovering new ways to improve the quality of a patient’s care but also to treat them more efficiently, effectively and economically.

Baker sees first hand the passion of Scott and his ability to make the complex simple. He even saw it more than three decades ago in his lab at KU.

“Even as a graduate student Randy was a complete outlier in terms of self-confidence and optimism,” Baker said. “Both were well-justified. Randy is remarkably intelligent.”

As a man with close to 30 patents, Scott knows a thing or two about innovation. As he says, “Innovation will solve our problems.”

But that innovation will take engineering, technology and the right science to realize its full potential, Scott said.

And it may take a scientist willing to realize the business potential of his solution.
year, coming from David Baker’s laboratory at the University of Washington. Karanicolas is a member of the Center for Bioinformatics, and has an interest in how structure meets function in proteins. His research focuses on the Nerve Growth Factor (NGF) cytokine, and it’s receptors. His goal is to use computer modeling to engineer designer NGFs that can activate only specific receptors to use as targeted therapeutics.

**Erik Lundquist** has continued his studies of nervous system development using the nematode *C. elegans*. These studies, funded by the NIH since 2001, have resulted in three peer-reviewed publications this year in internationally-recognized journals. Graduate students from Lundquist’s lab were authors on these papers, including Jamie Chapman, Rafael Demarco, and Hua Li. Jamie Chapman won the Twomey Award for her work. Lundquist was on sabbatical for fall of 2008 and did not teach Biology of Development. Instead, he used this time to conduct experiments and to write papers and grants. Lundquist also continued his service as a grant reviewer for the NIH study section Synapses, Cytoskeleton, and Trafficking.

**Brian Ackley** had a productive first year in his appointment at KU. He presented his work on synapse formation at a national meeting as well as two invited lectures at other institutions. Ackley was chosen to organize the *C. elegans* Neuronal Development conference for the summer of 2010. Ackley has seen his lab grow as he’s welcomed two new graduate students, Raymond Caylor and Elvis Huarcaya Najarro, to the lab.

In addition to his tireless efforts to recruit minority students to participate in research, **Jim Orr** has continued his research in understanding the influence of thromboxane, a chemical released from blood platelets, on stimulation of sensory nerves and contraction of blood vessels in the lung.

Finally, congratulations are in order for our colleague and dean, **Joe Steinmetz**, on receiving the prestigious Gantt Medal, the Pavlovian Society’s highest honor. Steinmetz research aims to understand how the brain circuitry works as a unit to understand behavioral response to external stimuli. Steinmetz work on the eyeblink response as a classical conditioning paradigm has earned him wide reknown and we’re extremely proud of his accomplishments.

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**Check out next Spring Symposium 2009!** Lectures from top scientists and posters on display.
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