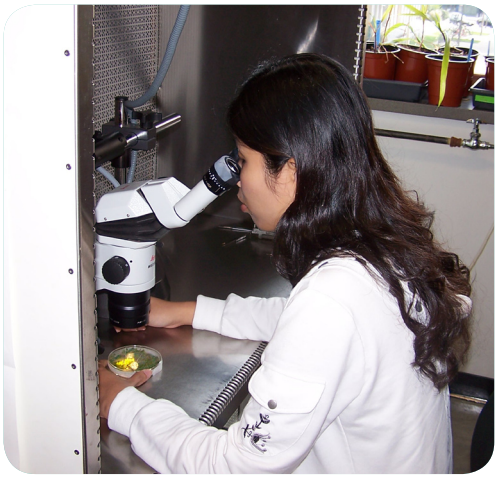
Department of
BIOLOGY NEWSLETTER
The University of Iowa

RESEARCH AND TEACHING FUNCTIONS OF THE UNIVERSITY

This is the last article in a series of four articles focusing on our research groups: Neurobiology, Cell and Developmental Biology, Evolution, and last but certainly not least Genetics. While Evolution is the great unifying concept of Biology bringing sense to the great diversity of organisms and their habitats, the gene and the transmission of genes from one generation to the next is the basis of evolution. The purview of Genetics is the gene and more: the organization of genes on chromosomes, the replication and passage of genetic information from one generation to the next, the processes that decode information in genes to produce protein products, the processes that regulate which genes are decoded at different times and in different tissues, and ultimately the relationship of genotype – the complement of genes present in any individual – to phenotype – the appearance and functional characteristics of that individual.

The pace of discovery in all of biology has been phenomenal, but in Genetics even the every day practitioners are overwhelmed. Several techniques have contributed greatly to the discovery process. These include: (1) the polymerase chain reaction (PCR), which permits rapid synthesis of large quantities of DNA for clinical diagnosis, forensic analysis, and basic research; (2) methods for automated, high-throughput DNA sequence analysis; (3) use of microarrays to generate large-scale readouts of gene activity for thousands of genes at a time; and (4) bioinformatics, the development of systematic computer based analyses of DNA sequence and microarray data. Microarrays are representations of the entire genome (all the genes of an organism), or selected parts of the genome "printed" onto microscope slides. These arrays can then be "probed" in a variety of ways to discover the subset of expressed genes (and other sequences) at any particular time and in any specific tissue or even in a particular cell type. Bioinformatic programs allow for rapid comparisons of many DNA sequences, including whole genomes, which would be impossible without this set of technologies. When these techniques are combined with the ever-expanding arsenal of molecular and cell biological tools the opportunities for a detailed analysis of gene expression are breath-taking.



Our genetics groups is augmented by two additional groups of investigators in the department, those using genetic tools in research programs that address questions in Neurobiology (Newsletter Fall 2005) or Cell & Developmental Biology (Newsletter Fall 2006) and by our group of evolutionary biologists (Newsletter Fall 2007), many of whom focus their programs at the level of the genome.

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College of Liberal Arts & Sciences

FALL 2008

FROM THE CHAIR

Dear Alumni and Friends,

I have now spent just a little over 2 months at my new job as the new chair of Biology. Right up front I want to state that I have been impressed about a number of things. First and foremost, the department staff is outstanding, a fact that became obvious during the crisis of this year's 500 year flood, a flood that caused damage in the order of 230 Mill $ (and rising) at the University of Iowa. While our Biology buildings were not directly hit by the flood waters, the power-outage combined with high humidity has taken its toll nonetheless. We are currently fighting mold in some of our buildings. More importantly, some of our faculty lost precious time during the research intensive summer months. During all this I was sidelined, working at my previous employment until July 1st, watching the interim chair, Steve Hendrix, and our Department Administrator, Tom Koeppel, handling the situation in a most expert way. Steve and Tom knew all the things about the campus and the Biology Buildings I am still studying and performed in a way I could not have as the new incoming chair.

The other major asset of this department I am familiarizing myself with is the faculty. As part of my initial survey of the department's strength and needs, I aim to obtain a complete inventory of our research strength through a series of individual and group discussions with each faculty. This process was structured such that members of all four main areas of research in the Department (Genetics, Cell and Developmental Biology, Neurobiology, Evolution) were grouped together for discussion about the future research directions and common research threats within each group. This process will be completed soon. Thus far, the insights I gained show me a research intensive department with faculty operating at the top tier of their respective discipline. Despite this very positive overall assessment, not everything is bright. As we all know, extramural funding is difficult to obtain and the Department of Biology feels the pinch as do many other departments. It is a testimony to our faculty that many managed to maintain a strong individual research program with substantial extramural support. However, as we move forward more efforts are needed to increase the individual funding level of each faculty and to obtain more group centered grants such as T32 or P30 awards. Such awards help forge group alliances which in turn can lead to more dynamic interactions and common grant applications tapping into the expertise offered by the excellent faculty we have in the department.

It was my pleasure to welcome 12 new PhD students to the department in August. These students have now started their first (of three) rotations and will provide added research strength to the department. While we managed to fund this many students for 2008/09, the department needs to obtain funds to be able to recruit and support as many students next year. A gift of $25,000 per year will support a graduate student for one academic year and will result in a specially named fellowship. In addition, such a donation will automatically make the donor a member of the Dean's Club Patron's Circle (www.biology.uiowa.edu /alumni.php). I am very much looking forward to watching this cohort of students make their scientific discoveries and receive their degrees during my tenure.

Lastly, for those who have not had a chance to meet me personally, a few words about me and my own funded research. Currently I am engaged in three main areas of research, molecular dissection of ear development to restore hearing loss (funded by an RO1 grant form NIH), fine tuning of diffusion and chromatic properties of dyes for tracing (funded by and SBIR II from NIH) and understanding the molecular basis of eye muscle innervations (a subcontract with Children's Hospital, Boston; also funded by NIH). It will be a tall order to balance this research commitment, maintain my extramural support and provide good stewardship for the Department, the graduate program and the undergraduate teaching. The previous chair, Jack Lilien showed me that it can be done and I will try to be as effective as he was on all these accounts.

Bernd Fritzsch, Ph.D.
Professor and Chair

UNDERGRADUATE FIRST YEAR SEMINARS

The First-Year Seminar Program gives freshman undergraduate students the opportunity to learn specifics about a topic in which they may be interested by participating in a small seminar class for no more than 15-16 people. The courses do not offer General Education Program credit nor can they be used for courses which apply toward a major. The seminars are taught by UI Professors giving each professor an opportunity to teach topics about their own research or area of interest. Each seminar offers students an opportunity to focus on unusual and interesting topics chosen by some of our most exciting professors. Two Biology department professors, Chi-Lien Cheng and Erin Irish, will teach the following seminars.

FALL 2008

Chi-Lien Cheng

The use of man-made nanomaterials (particles with diameters 1-100nm) in industries such as medicine, plastics, energy, electronics, and aerospace is growing rapidly. Because of their wide applications, it is unavoidable that these materials will be introduced in increasing amounts into the air, water, and soil. Nanoparticles can enter the human body directly or through the food chain. Only recently has attention been paid to their possible effects on human health. Very little is known about the possible impact of nanoparticles on our environment. In this course, the class will identify the key nanomaterials being used in industry, with special emphasis on those that are used in Iowa, their possible routes for entering the environment, and what is known about their effect on living organisms. Readings will include both popular and research articles. With help from the instructor, each student will choose a topic, identify reading materials to be read by the entire class, and lead the discussion.

SPRING 2009

Erin Irish

Some of our foods need no more treatment than a quick rinse with clean water before they are ready for consumption. Others benefit from a wide variety of more extensive treatments such as heating or fermentation. This course will consider the chemical make-up of foods, their biological origins, and how cooking alters it to make it more palatable, digestible, or safer. An important goal of the course is to apply the principles of biology and chemistry at a college level. The course will consist of a combination of instructor- and student- led discussions of assigned topics.

NEW FACULTY

JOHN MANAK

My lab uses microarray technologies combined with molecular genetics in flies to study the modulation of chromatin structure by the Myb-MuvB/dREAM complex. This complex contains the Drosophila homolog of the c-Myb proto-oncogene (Dm-Myb) as well as the cell cycle regulators E2F2 and DP, the tumor suppressor proteins RBF1 and RBF2, the deacetylase Rpd3, all the components of NURF (Nucleosome Remodeling Factor) and several other factors. We have previously shown that Dm-Myb concentrates on DNA during S phase and is involved in a variety of chromatin-related processes including transcriptional regulation of target genes, control of DNA replication of a specialized set of genes during egg cell development, maintenance of chromatin integrity, and condensation of euchromatin during M phase. We have also shown that the Myb-MuvB complex binds to transcriptional start sites and appears to remain bound together largely as a holocomplex. More recently, we have provided evidence that Dm-Myb is facilitating the deposition of the centromeric Cid/CENP-A histone variant and may also be involved in facilitating deposition of other histones as well. However, no studies to date have attempted on a genomic level to temporally determine how the Myb-MuvB complex functions. We are now in the process of using cell culture techniques to synchronize Drosophila cells in the context of RNAi of the Myb-MuvB complex members to address how Myb modulates chromatin structure. By using the ChIP on chip microarray methodology, we wish to determine over the course of the cell cycle how and where the Myb complex is functioning to, 1) facilitate deposition of both standard and variant histones, and, 2) facilitate covalent modification of histones (such as acetylation, methylation, phosphorylation, etc). We are also using genetics to determine whether Myb genetically interacts with genes involved in histone deposition and modification.

Additionally, my lab (in collaboration with human geneticists at the University of Iowa College of Medicine) is using microarray technology to help find mutations that cause human disease. Based on a novel strategy I developed to map mutations in flies to the genes they affect, we will hybridize tiled genomic microarrays that represent regions of the genome implicated in human disease with various cDNA samples to find novel exons of genes within those regions. The newly discovered novel exons (and regions nearby those exons) will then be sequenced in afflicted individuals to determine whether mutations can be identified that lead to the disease.

Finally, my lab is collaborating with several laboratories world-wide to use tiled genomic microarrays to empirically annotate (and, in one case, help assemble) a number of genomes including Oikopleura dioica (with the Thompson and Chourrout groups in Norway), Tribolium castaneum (with the Brown group at Kansas State University), and Daphnia pulex (with the Colbourne and Cherbas groups at Indiana University). This strategy is identifying a large number of previously unknown transcripts produced from these genomes.

NEW FACULTY

MAURINE NEIMAN

Sexual females produce both sons and daughters, while asexual females make only daughters. Since only females produce offspring, this "cost of males" predicts that sex should be rare because asexual females will leave many more descendants than will sexual females. In reality, however, sex predominates. Despite years of study, why sex is so common despite the cost of males remains unclear, and is considered one of the most important unanswered questions in evolutionary biology. The answer to this question will come from comparing sexual and asexual organisms, with the goal of identifying disadvantages of asexuality. Much of our research involves comparisons between sexual and asexual snails native to New Zealand.

While our lab has an evolutionary focus, we bring together ideas and tools from ecology, behavior, and molecular/cell biology. One set of projects revolves around testing the hypothesis that asexuality is rare because sex is required to produce offspring that are free from harmful mutations. Another primary research focus is on the difference in chromosome number between sexuals and asexuals: most sexual organisms have two sets of chromosomes, while most asexuals have three. Since chromosomes are phosphorus-rich, asexual organisms will often contain and thus require more of this commonly limiting nutrient. We are using lab- and field-based experiments to determine whether this provides sexuals an advantage when phosphorus availability is low. Finally, we have used laboratory experiments to demonstrate that asexual female snails negatively affect each other's reproduction, and are studying snail behavior and population ecology to better understand why. This research is especially interesting in light of the fact that the snail species that we study is invading freshwaters all over the world. Our research can provide new understanding of invasion dynamics, and perhaps inspire ideas about how better to control the invading populations.

CONGRATULATIONS
GRADUATES OF BIOLOGY

Ph.D.s

Elisabeth Gustafson-Wagner

Fall 2007 (Lin Lab)
"Characterizing the functions of the novel Xin genes in the mouse heart"

Jie Huang

Fall 2007 (Green Lab)
"Depolarization-dependent pro-survival signaling in spiral ganglion neurons"

Wei Wu

Fall 2007 (Soll Lab)
"Mating-type zygosity and virulence in a human pathogenic fungus, Candida albicans"

Shaun Grosskurth

Spring 2008 (Lin Lab)
"Differentially expressed genes in striated muscle development and function"

Shannon Harlan

Spring 2008 (Lin Lab)
"Regulation of the rat cardiac troponin T promoter during development and in the adult"

Jihye Lee

Spring 2008 (Wu Lab)
"Effects of K and Ca channel mutations on synaptic function and growth in Drosophila larval neuromuscular junctions"

M.S.s

Wenjia Chen

Spring 2008 (Wu Lab)
"Adhesion and temperature modulation of neuronal growth in Drosophila channel and signaling mutants"

Yasir Ahmed

Summer 2008 (McAllister Lab)
"Reproductive incompatability in allopatry between D. Americana and D.novamexicana"

FACULTY ACTIVITY NEW GRANTS

D. Bhattacharya has been awarded two grants: A workshop, "Where to next with the tree of life?" from the NSF (Emerging Frontiers, AToL Program); "En-Gen: Gene expression and harmful algal bloom dynamics", from the NSF (Emerging Frontiers, Environmental Genomics (Co-PI).

B.Fritzsch awarded a 3 year grant with NIH "Dissecting the ear neurosensory development" and Small Business Initiative Research through MITT.

S.H. Green won a 5-year competitive grant renewal from the NIH, "Stimuli promoting survival of spiral ganglion neurons", and obtained a Predoctoral Fellowship for J. Huang from the Amer. Heart Assoc. Heartland Affiliate.

S.D. Hendrix was granted funds from the UI Biological Sciences Funding Program (with J. Miller), "Ecological genomics of insect induced plant galls."

D.W. Houston has a 5 year award from NIH "Localized mRNAs in vertebrate axis formation".

A.R. Kay was awarded a 1 year NIH EHSRC pilot grant.

J.M. Logsdon has received a 5-year grant from the NIH, "Meiotic genes in sexual and asexual rotifers".

R.E. Malone has received funding for 3 years from the NSF for "The coordination of recombination initiation and the first division in meiosis."

Developmental Studies Hybridoma Bank was awarded the National Cancer Institute initiative for hybridoma diagnostics and initiated projects with Des Moines University College of Osteopathy and the Mercy Hospital System in Des Moines.

Roy J Carver Center for Comparative Genomics was awarded a $250,000 expansion grant from the Roy J. Carver Foundation to purchase a multiphoton microscope.

NEW APPOINTMENTS *as Panelists, Editors and Society Officers, etc.*

D. Bhattacharya was the Organizer of the NSF-sponsored workshop, "Where next with the tree of life, April, 2008, Washington, DC, and Lead Organizer of a discussion session on genomic approaches in HAB research, the Fourth Symposium on Harmful Algae, November. 2007, Woods Hole, MA. He also co-organized a US-European Commission Workshop on Cyberinfrastructure Resources for Genome-Enabled Research on Microbial Life and the Marine Environment, Sept., 2007, Washingrton, DC, and the NSF-funded symposium, "Borrowed chloroplasts: Secondary Endosynbiosis and the Chromalveolates, July, 2007, Botanical Society of America, Chicago, IL. He chaired the Advisory Board of the CCMP Provasoli-Guillard National Center for Culture of Marine Phytoplankton, Bigelow, ME.

J.M. Comeron served as a Panelist for the NSF, Doctoral Dissertation Improvement Grant (DDIG). Population and Evolutionary Processes (PEP) Cluster.

D.F. Eberl functioned as temporary member of the AUD research grant Study Section of the NIH, June, '07.

B.Fritzsch – NIH Study Section Member. Co-Editor of BMC - Development.

A.R. Kay was chairman of a scientific session at the 1st International Society for Zinc Biology meeting, Banff, Canada.

J.M. Logsdon was appointed for 2 years as Committee Member to NSF's Graduate Research Fellowship Program. He also received appointments to the Program Committee for the annual meeting of the Molecular Biology and Evolution Society, to the Organizing Committee of the German-American Frontiers of Science Symposium, von Humbolt Foundation and the NSF for meetings in 2007 and 2008, and as Organizer of the Division X Symposium, "Microbial roots and branches on the eukaryotic tree of life", Amer. Soc. for Microbiology, Toronto, Canada.

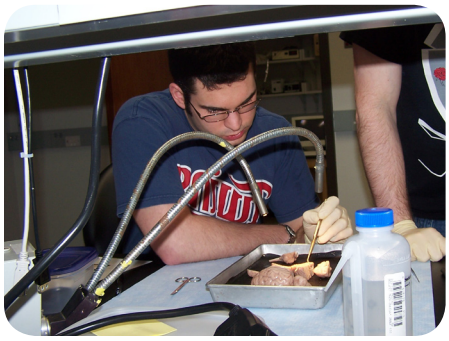
B.F. McAllister has been appointed Associate Editor of the journal, Genetica.

C.-F. Wu has been appointed Editor-in-Chief of the Journal of Neurogenetics. Dr. Wu also co-chaired a session, "Ion channels" at the 11th European Symposium on Drosophila Neurobiology, Wuerzburg, Germany, and was Chair of the section on "Synaptic transmission", CSHL meeting on "Neurobiology of Drosophila", Cold Spring Harbor, NY.

BIOLOGY DEPARTMENT UNVEILS

NEW NEUROBIOLOGY LAB COURSE

Neurobiology is now one of the most popular undergraduate tracks in the Department, but students in this track have had no discipline-specific investigative lab course to provide hands-on technical and research training…until now! This past spring, the Department rolled out a new Neurobiology Lab course to meet the specific needs of students interested in this rapidly growing area of biology. The course has been under development for a couple of years and was taught by Professors Michael Dailey and Alan Kay, who were assisted by a graduate teaching assistant, Zhe Wang (Wu lab), and a research assistant, Greg Tinkler. Eight students were selected to participate in the inaugural class.

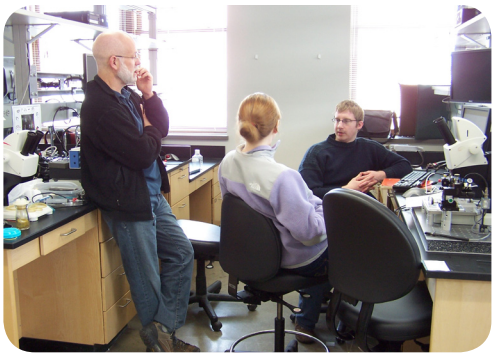


Preparation for the course included renovation of new teaching lab space (room 113BB), including separate microscopy and tissue culture suites. The main lab has a unique teaching arrangement whereby each student workstation has a direct video feed from the instructor's

workstation, enabling students to clearly view the instructor's presentation of data and specimens. To equip the lab for student use, the University, College, and Department together contributed over $100,000 towards the purchase of state-of-the-art laboratory equipment, including computer workstations, electrophysiology rigs, digital dissection microscopes, a cell culture incubator, and a tissue culture hood.

The course covered a fairly broad range of physiological and anatomical concepts and techniques including: fundamentals of neuro-physiological recording and instrumentation; human electromyography; electrophysiological analysis of muscle and nerve in live crayfish and Drosophila preparations; sheep brain dissection and comparative neuroanatomy; classic histological and immunofluorescence staining of rodent brain sections; confocal and digital fluorescence imaging; and time-lapse analysis of live, cultured cells. The students especially enjoyed a field trip to the cadaver lab in the College of Medicine to examine human pathological brain specimens (thanks to Dr. Martin Cassell).

Feedback from the first class of students was overwhelmingly positive. With a future expansion to 24 students per semester, this course will provide unique opportunities and experiences for many students seeking an introduction to the principals and practice of neurobiological and biomedical research.



AWARDS AND HONORS:

Josep Comeron, Ph.D. - Promoted to Associate Professor
Alan Kay, Ph.D. - Promoted to Full Professor
Joseph Frankel, Ph.D. - Collegiate Teaching Award
Bryant McAllister, Ph.D. - Dean's Scholar Award, promoted to Associate Professor
John Menninger, Ph.D. - Brody Award for Excellence in Service
Jonathan Poulton, D.Phil. - Outstanding Honors Teacher
Phil Ecklund - Professional Development Award
Demelza Koehn - Outstanding TA Award
Amy Korthank - Professional Development Award
Michelle Worrell - Mary Louise Kelly Award for staff excellence

Poster Award:
Nidhi Sahni - (Soll Lab) Outstanding investigator award at ASM conference
Adam Althaus - (Dailey Lab) Outstanding poster presentation by IA Center of Research by Undergraduates

Years in Biology:
Dean Abel- 20 Years
Karla Daniels- 10 Years
Amy Korthank- 10 Years
Ken Snyder- 10 Years

FOCUS ON RESEARCH

Continued from cover

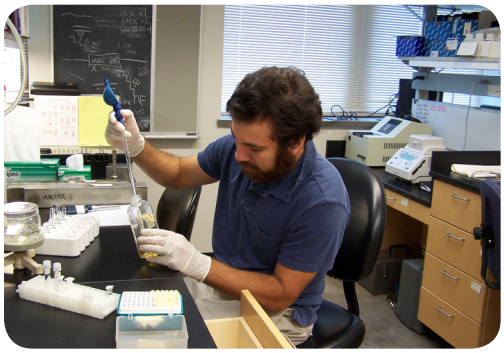
The newest member of our Genetics group is **John Manak**. John joined the department in January of 2008 and is now planning the initial stages of his research. Dr. Manak's research will make use of the fruit fly, Drosophila melanogaster, as the organism of choice. Drosophila is a terrific system because it is amenable to genetic studies,

has a short generation time, and has the most completely analyzed genome of any complex organism. John is studying a set of genes that are very, very closely related to human genes involved in disease and cancer. In fact, it turns out that at least 60 % of the genes involved in human disease and cancer are closely related to similar genes that are present in flies. The particular genes under study encode novel, uncharacterized proteins that likely bind to DNA or chromatin (which is DNA plus the proteins bound to it) in the nucleus. Using microarrays, Dr. Manak is working on a map that will show where these proteins bind at specific sites across the entire fly genome; such information will help determine how these proteins function and will allow identification of proteins that act together in complexes to exert their functions. For example, such proteins may function by regulating expression of a particular set of genes, by regulating replication of DNA, or by modulating the actual structure/function of the chromatin itself. Because of the similarity to human genes, the results of these studies will contribute to our understanding of how these genes may cause disease when mutated.

John's laboratory is also using microarrays to help find mutations that cause human disease. These studies are based on a novel strategy he initially developed in the fly system to find unidentified regions of genes (novel exons) that represent regions of the human genome possibly linked to disease due to their ability to accumulate mutations. The novel exons (and regions near them) will then be sequenced in afflicted individuals to determine whether mutations can be identified that lead directly to the disease.

At the very heart of Genetics in eukaryotic cells is the process that reduces the number of chromosomes from two (the diploid state) of each kind to one of each (the haploid state) during formation of sex cells (sperm, eggs, pollen, spores, etc.). This special reduction process, meiosis, is highly conserved in all eukaryotes and in 99.99% of these organisms includes the same five steps. That is, meiosis is the same in single celled amoebae or yeasts, in complex plants, or in animals including humans. (Issue # Fall 2007 Focus on Evolution has much more to say on this matter.) **Bob Malone's** laboratory studies chromosome behavior during meiosis, in the baker's yeast, Saccharomyces cerevisiae, because of it ease of genetic manipulation and its extraordinarily well characterized genome.

Two essential events unique to meiosis are genetic recombination, the process that allows exchange of genes between the two duplicate (but not identical) chromosomes, and the first cell division. The Malone laboratory has defined, cloned, and analyzed, both genetically and molecularly, all 10 genes required to begin the recombination process, focusing in particular on six of the genes that only have a role in meiosis. Dr. Malone and his students are working to understand how the gene products interact to initiate recombination. This process is extremely



important, as without proper recombination, chromosomes mis-divide during the first division and this mis-division is the largest cause of human birth defects. Birth defects in humans such as trisomy 21 (Down Syndrome) are most often caused by defects in meisosis, which result in improper distribution of chromosomes to the germ cells or gametes.

Given the importance of the orderly distribution of chromosomes during meiosis, it would seem reasonable that there are mechanisms to insure that the steps occur in the proper order. The Malone laboratory has also characterized a novel coordination mechanism that allows the cell to monitor if the functions essential to initiate recombination are present; and if so, to allow time during meiosis for the actual exchange process to occur.

A key feature that distinguishes the life cycle of plants from that of animals is that in plants, a haploid form, which we usually think of only in the context of germ cells (as Dr. Malone's research), can be a free living organism. The haploid organism, called a gametophyte, has little resemblance to the diploid plant, termed the sporophyte. Gametophytes produce eggs and sperm, and through sexual union, sporophytes. In more familiar "higher" plants, the dominant generation is the diploid sporophyte and the tiny gametophyte is imbedded in the flower. In some "lower" plants, such as the mosses, the dominance of the two generations is reversed: tiny sporophytes grow on the dominant gametophytes. In a third variation displayed by ferns, the two generations grow as independent individuals. **Chi-Lien Cheng** has been

studying the genetic program that controls this so-called "alternation of generations" with the ultimate goal of understanding how the genetic program is regulated to produce the two vastly different life forms and how this genetic program has evolved among land plants. To address this question Dr. Cheng's laboratory is attempting to identify the fern genes that regulate the transition from gametophyte to sporophyte. These genes will then be used to identify their counterparts in the higher plants. In addition to answering a fundamental biological question, genes regulating gametophyte or sporophyte generations identified in higher plants may be of added value by allowing fruit production without undergoing sexual reproduction, a technique of considerable commercial value.

The capacity for regulation of gene expression enables successful adaptation of organisms to environmental change. Changes in gene expression in response to the environment involve the recognition of external signals and conversion of those signals into information that can be transmitted to the nucleus and ultimately activate genes. Three of our faculty members are interested in how organisms respond to stress. You already read about the work of Lilach Hadany in the write-up on our Evolutionary Biologists; in this article we feature two of our geneticists,

RESEARCH ACTIVITES OF THE BERND FRITZCH LAB SINCE MOVING TO IOWA - JULY 2008

The first activities were centered around setting up the laboratory, learning the use of the new confocal microscope and getting the work started of a new postdoctoral student, Elaine Wong, from Hong Kong. In parallel to the understanding of the inner workings of the department and gradually assuming more responsibilities as departmental chair, the following research was accomplished in July:

A cover for a journal highlighting the ear was requested and submitted to illustrate a minireview on hair cell regeneration to restore hearing loss through the use of induced stem cells (iPS cells). (Beisel K, Hansen L, Soukup G, Fritzsch B. (2008) Regenerating cochlear hair cells: quo vadis stem cell. Cell & Tissue Research, e-publication June 25, 2008). This marks, incidentally, the first paper published under my new address and the first journal cover for me at the University of Iowa.

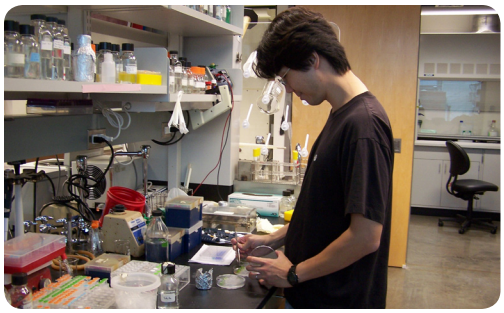
A paper on the effect of a major transcription factor on ear development was finalized and will be submitted in early August (David H. Nichols, Sarah Pauley, Israt Jahan, Kirk W. Beisel, Kathleen J. Millen and Bernd Fritzsch (2008) Lmx1a is required for segregation of sensory epithelia and normal ear histogenesis and morphogenesis). This paper highlights the importance of understanding regulatory transcription factors that are expressed outside the ear neurosensory domains but have nevertheless important functional roles on the development of neurosensory areas of the ear, including the formation of the mechanotransducing hair cells needed for hearing. This paper is the first in a series that will highlight the functional role of the four Islet-Lim homeodomain factors in the ear that are already known to play crucial roles in motoneuron, cerebellum, choroid plexus and islet cells of the pancreas. As such, understanding the function of these transcription factors in ear development will add to our conceptualization of ear development needed to recapitulate hair cell regeneration for restoration of hearing loss. A second paper dealing with the functional role of conditionally deleted Isl1 in the ear is in an advanced stage of a manuscript.

A major novel area of research was started on the function of misexpression of a powerful transcption factor, the homeobox gene HoxB3.

Homeobox genes are the basis for homeotic transformation of fly segments and the expectation is that such misexpression will lead to homeotic transformation in the mouse hindbrain: turning a more anterior segment to assume a more caudal phenotype. Our data on motoneurons gathered in the last three weeks are reasonably consistent with this hypothesis. However, an unexpected added side effect is a major derailment of ear development. Since HoxB3 is not normally expressed in the ear, this indicates that misexpression of such a powerful transcription factor can cause major reorganization of normal development through disregulation of multiple other genes. Clearly, fully understanding this transgenic misexpressor will take not only the three months of the current work planned with my postdoctoral student but much longer. September 22, we moved the lab to its permanent location.

Jan Fassler and **Ming-Che Shih**.

In the **Fassler** laboratory a combination of genetic, molecular, and biochemical techniques are used to investigate the response of baker's yeast, Saccharomyces cerevisiae to externally applied stress. Dr. Fassler has found that the pathway followed between receipt of the stimulus and gene activation is branched and that the two branches of the pathway are reciprocally regulated. When the activity of one branch is increased, the activity of the other is decreased. This suggests that cells need to coordinate the stress response with aspects of normal cell growth. A variety of genetic screens, biochemical assays, and microarray analysis have been used to identify molecules involved in each of the two branches of the environmental stress pathway in the hope of clarifying how the information is transferred between molecules along the pathway, what additional environmental, physical and chemical signals activate the pathway, and what the functional relationships between the two branches of the pathway are. One conclusion based on the research so far is quite heretical. Previously, the response to osmotic stress was widely believed to be stimulated in response to changes in pressure against the yeast cell wall. This is logical and intuitive, but recent experiments in the Fassler laboratory suggest that changes in the structure of the yeast cell



wall may be an important trigger for the osmotic stress response.

The Fassler lab is also investigating the extent to which osmotic stress genes identified in the innocuous baker's yeast are counterparts of genes involved in virulence in the pathogenic yeast, Candida glabrata. Although standard pathogenesis assays involve infecting mammalian animal models such as mice or rats with the pathogen, the Fassler lab has adopted a simpler and more cost-effective assay involving the nematode, C. elegans. The figures show that worms fed on C. glabrata yeast have higher death rates than worms fed on E. coli. Next, the lab plans to investigate whether osmotic stress genes play any role in the killing of worms by C. glabrata.

Ming-Che Shih wears two hats like many of our faculty. You have already read about one of the projects going on his laboratory (the evolution of the regulatory networks that control the response of plants to stress) in the last issue highlighting the Evolution group. A second program, also dealing with environmental stress, places Dr. Shih's research squarely in purview of the Genetics group. This research program concerns how higher plants sense and respond to low oxygen (hypoxia) and oxygen deprivation (anoxia). Expression of the alcohol dehydrogenase gene (ADH) is a characteristic response to hypoxia and Dr. Shih's laboratory has isolated several mutants in the genetically well characterized plant Arabidopsis that are defective in the pathways that mediate this response. Characterization of one of these mutants suggests that jasmonate (a plant hormone) functions as a key signaling molecule in the pathways that turn on the ADH gene.

The ADH gene is also induced by several other stresses, including cold, dehydration, and salt. This leads to the question of whether all these distinct stresses act through a common pathway. By combining experimental and computational approaches, Dr. Shih's group has identified a genomic region that is essential in turning on the ADH gene. These results have led to the hypothesis that different stresses activate expression of the ADH gene by signaling through this same genomic region.

UNDERGRAD RESEARCH ACHIEVEMENT AWARDEES

ROBBIE PRIZE

The ***Robbie Prize*** is given annually to an undergraduate senior Biology major who demonstrates excellence in course work and research, and who is preparing for a career in science. The award was established in 1969 with a bequest from the family of James P. Robbie (B.A., 1964 in Zoology and mathematics) in his memory. The award carries a prize of $300 which includes a supplement from the Biology Department Development Fund.

The Department of Biology has awarded the ***2008 Robbie Prize*** to **Adam Althaus**, who worked with **Dr. Michael Dailey** on mice brain hippocampus. This lab focuses on microglia, which are neuronal support cells that mediate the immune system function in the brain. The aim of Adam's research project was to learn how microglia respond to apoptotic neurons. The injury model was oxygen/glucose deprivation (OGD), which models a stroke-like injury. The mice used were transgenic with the gene for Green Fluorescent Protein (GFP), being expressed primarily in microglial cells in the brain. After OGD treatment, GFP-expressing hippocampal slices were imaged using a confocal microscope to characterize the microglial response. Adam discovered that microglia indeed display a response to OGD treatment that differs from the response characterized by other injury models. This model will now be used to learn more about the mechanism and time course of the microglial response.

CLIFFORD W. HESSELTINE SCHOLARSHIPS

The ***Clifford W. Hesseltine*** Scholarship in Biology is awarded annually to an outstanding senior Biology major who has done noteworthy research, and/or is intending graduate work with micro-organisms. The award is a prize of $300.

2008 Clifford W. Hesseltine Scholarships in Biology ($300) were awarded to Scott Pate and Ryan Teahen, both Biology majors in their junior year, who have displayed excellence in both course-work and research.

Although the etiology of orofacial clefts is complex, strides in elucidating major genetic contributors have been made in recent years. Building on previous investigations, **Scott Pate's** research in **Dr. Jeffrey Murray's** lab investigated single nucleotide polymorphisms in family triads collected by Dr. Ron Munger of Utah State University. The population contains over one thousand triads, in which the parents were phenotypically normal but the child was affected by orofacial clefting. Furthermore, a novelty of these samples is that maternal nutritional information (e.g. folic acid and homocysteine levels) was also collected. Genes involved in folic acid and methionine metabolism were assayed using Taqman PCR to detect linkage disequilibrium. Such research may contribute to future genetic screenings, allowing parents to know their risk for having a child with orofacial clefting. Perhaps more importantly, specific diets could be formulated for pregnant mothers before and after genetic testing.

Ryan Teahen's research in **Dr. Diane Slusarski's** lab focused on vertebrate anterior-posterior patterning through early development with particular focus upon the gene *Wdr-82*. The protein product of *Wdr-82* serves as a transcription factor implicated in *HOX* gene expression. *Wdr-82* has been shown to maintain a vital molecular role in yeast, but its role in vertebrates is less well understood. Diminished expression of the *Wdr-82* has been correlated with human diseases including blindness and autism. Using the zebrafish as model organism, whole mount in situ hybridization was used to analyze the effects of *Wdr-82* gene knockdown in conjunction with riboprobes specific to the brain (*Krox* and *Pax*) and the heart (*Nkx2.5*). Interestingly, early heart development and both early and late stages of brain development were unaltered by knockdown. However, morphologic changes in the heart region became obvious after embryogenesis. Gene knockdown consistently led to an enlarged pericardium and cardiac arrhythmias, ultimately ending in heart failure.

EVELYN HART WATSON SCHOLARSHIP

The ***Evelyn Hart Watson Scholarship***, part of a bequest to the Department from Mrs. Watson's estate, is awarded to a freshman Biology major with exceptional promise. It carries an award of $500, renewable for three additional years assuming satisfactory progress towards an honors degree.

2008 Evelyn Hart Watson Scholars:
Laura Henkle from Springfield High School, Springfield, IL

Kathryn Houselog from Wahlert High School, Dubuque, IA

LOWDEN PRIZE IN BIOLOGY

The ***Lowden Prize in Biology*** is awarded to an undergraduate student showing outstanding performance in the *2:134 Ecology* course.

2008 Lowden Prize in Biology:
Lindsey Loban (Slusarski Lab)

IOWA CENTER FOR RESEARCH BY UNDERGRADUATES (ICRU)

2007 Excellence in Undergraduate Research Award (Natural Sciences):
Adam Althaus (Dailey Lab)

RHODES DUNLAP SCHOLARSHIP

Rhodes Dunlap Collegiate Scholarship ($2,000) recognizes academic merit and/or community involvement:
Atul Nakhasi

UI HONORS PROGRAM

The ***UI Honors Program's 2008 Collegiate Scholars Awards*** ($100) are granted to a select group of graduating seniors and is based on outstanding academic accomplishment.
Adam Althaus (Dailey Lab)
Sandra Imoehl (Murray Lab)

OTHER BIOLOGY AWARD WINNERS:

Don Pham - *Alexander Kern Scholarship*
Jessica Odendahl - *Faith M. Knowler Scholarship*
Christina Willner - *Velma E. Stuit Scholarship for Women in Mathematics, Statistics, Chemistry, Physics, or other Sciences*

BIOLOGY HONORS GRADUATES

(December 2007, May 2008, and July 2008):
Adam Althaus (Dailey Lab)
Jean Caligiuri (Hendrix Lab)
Drew Gripentrog (McAllister Lab)
Alison Hanson (Murray Lab)
Timothy Helms (Murray Lab)
Amy Hertz (Eberl Lab)
Sandra Imoehl (Murray Lab)
Lindsey Loban (Slusarski Lab)
Ning Lu (Wu Lab)
Dhwani Patel (Stipp Lab)
Michael Saul (Green Lab)
Brett Weiss (Dailey Lab)
Jaime Williams (Malone Lab)
Joshua Williams (Eberl Lab)

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143 Biology Building
Iowa City, IA 52242-1324

Fill out the **ALUMNI PAGE** of our website http://www.biology.uiowa.edu/alumni.php

EMAIL US: Biological-sciences@uiowa.edu

Feel free to send us any questions or comments – we are waiting to hear from you!

HONOR ROLL
OF CONTRIBUTORS

This honor roll gratefully recognizes graduates, faculty, and friends who contributed $100 or more from July 7, 2007, through June 2008, to the Department of Biological Sciences through The University of Iowa Foundation, the preferred channel for private support of all areas of the University.

Contributors are listed alphabetically. A (PC) follows the names of those who qualified for membership in the College of Liberal Arts and Sciences Dean's Club Patrons Circle by contributing $2,500 or more to any area in the College of Liberal Arts and Sciences from July 7, 2007, through June 2008. Contributors of $1,000 to $2,500 from July 7, 2007, through June 2008, qualify for the College of Liberal Arts and Sciences Dean's Club, which is indicated by a (DC) following their names.

Allhiser, Carin L., Appleton, Wis.
Allhiser, John N., Appleton, Wis.
Andrews, Betty J., Hot Springs Village, Ark.
Andrews, Ted F., Hot Springs Village, Ark.
Arens, David E., Des Moines, Iowa
Arens, Marsha L., Des Moines, Iowa
Bagnara, Joseph T., Tucson, Ariz.
Bagnara, Mary Louise, Tucson, Ariz.
Buffo, Jeffrey J., Cedar Rapids, Iowa
Burns, Elizabeth A., Grand Forks, N.D.
Cairns, J. Scott, Mercer Island, Wash.
Roy J. Carver Charitable Trust, Muscatine, Iowa (PC)
Cech, Annette M., Des Moines, Iowa
Cech, Robert F., Des Moines, Iowa
Cherwin, Jerrold L., Arlington Heights, Ill.
Cherwin, Jessica M., Arlington Heights, Ill.
Chouinard, Claire C., Medford, Mass.
Chouinard, Scott W., Medford, Mass.
Cole, Margaret M., Boulder, Colo.
Cole, Theodore C., II, Boulder, Colo.
Crawford, Adam, Dublin, Ohio
Dahl, Carol A., Mercer Island, Wash.
Daves, Bret A., Ankeny, Iowa
Davis, Jennifer M., New York, N.Y.
Easton, Douglas P., Tonawanda, N.Y.
Edwards, Kevin B., Milwaukee, Wis.
Erickson, Nancy Nielsen, Missoula, Mont.
Erickson, Ronald E., Missoula, Mont.
Fahr, Elizabeth S., Iowa City, Iowa (DC)
Filos-Diaz, J. A., Panama, Panama (PC)
Gelfand, Lawrence E., Iowa City, Iowa
Gelfand, Miriam J., Iowa City, Iowa
Griffith, D. Gary, Jamaica Plain, Mass.
Harbour, Laurel J., Leawood, Kan. (PC)
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Havey, Kathleen S., Wilmington, Ohio
Heithaus, Patricia A. Smith, Mount Vernon, Ohio
Hemesath, Timothy J., Jersey City, N.J.
Hendrix, Stephen D., Iowa City, Iowa (DC)
Ho, Teh-Yuan, East Brunswick, N.J.
Hoff, Kay L., Lincoln, Neb.
Hoff, Richard L., Lincoln, Neb.
Holbrook, Mark A., Iowa City, Iowa (DC)
Jane, Nicole M., South Lake Tahoe, Calif.
Johnson, Gwen M., Moorland, Iowa (DC)
Johnson, James L., Moorland, Iowa (DC)
Kaung, Hue-Lee, Cleveland, Ohio (DC)
Kaung, Thomas T. S., Cleveland, Ohio (DC)
Kessel, Richard G., Iowa City, Iowa (DC)
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Lansing, Jeanne G., Cary, N.C.
Lansing, Timothy J., Cary, N.C.
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Leff, Todd A., Ann Arbor, Mich.
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Lin, Jim Jung-Ching, Iowa City, Iowa (DC)
Lin, Yu-Tieh, East Brunswick, N.J.
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Lynch, G. Robert, Boulder, Colo. (DC)
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Maxson, Rick, Iowa City, Iowa (DC)
McDougall, Heather E., Burnsville, Minn.
Mills, Kay W., Augusta, Ga.
Mills, Thomas M., Augusta, Ga.
Mintz, Beatrice, Elkins Park, Pa.
Mohler, Bobby A., Waldport, Ore.
Mohler, James D., Waldport, Ore.
Nilles, Joan M., Storm Lake, Iowa
Ostedgaard, David Lee, Iowa City, Iowa
Ostedgaard, Lynda S., Iowa City, Iowa
Perkins, Greg L., Carroll, Iowa
Pollack, Christine F., Skokie, Ill.
Pollack, Emanuel D., Skokie, Ill.
de Ponseti, Helena Percas, Iowa City, Iowa (DC)
Ponseti, Ignacio V., Iowa City, Iowa (DC)
Reiter, Rebecca S., Iowa City, Iowa
Rice, David R., Seattle, Wash. (PC)
Rice, Joan E. Sorensen, Seattle, Wash. (PC)
Ring-Easton, Rosellen, Tonawanda, N.Y.
Sampsell, Bonnie M., Chapel Hill, N.C.
Schardein, James L., Chelsea, Mich.
Schmidt, Jean M., Waterloo, Iowa
Sedar, Jean Dimmitt, Cherry Hill, N.J.
Sherman, Hildegard, Little Rock, Ark.
Sherman, Jerome K., Little Rock, Ark.
Sjolund, Richard D., Solon, Iowa
Sjolund, Rina R., Solon, Iowa
Smith, Blanche, Los Angeles, Calif.
Smith, Larry J., Roscoe, Ill.
Smith, Phillip M., Sr., Los Angeles, Calif.
Sullivan, Anne L. S., Coralville, Iowa
Sullivan, Michael J., Coralville, Iowa
Swartzendruber, Donald C., Coralville, Iowa
Vollstedt, Jaclyn R., Sioux City, Iowa
Vollstedt, Keith A., Sioux City, Iowa
Von Eschen, LeAnn K., Columbia Heights, Minn.
Walker, William K., Yorktown, Va.
Ward, Jeffrey W., Potomac, Md. (DC)
Ward, Sharon M., Potomac, Md. (DC)
Yen, Kwang-Mu, Thousand Oaks, Calif.
Zallek, Chris, East Peoria, Ill.
Zallek, Sarah, East Peoria, Ill.
Zinser, Roger A., Grand Forks, N.D.

THE DEPARTMENT OF BIOLOGICAL SCIENCES DEVELOPMENT FUND

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The Biology Department wishes to thank; the Developmental Studies Hybridoma Bank and David R. Soll for their continued support and contributions; and Jack Lilien & Janne Balsamo for their continued support of our Graduate Student Recruiting Efforts.

GRADUATE FRIENDS & ALUMNI FELLOWSHIP FUND

This new fund has been created to provide support for our graduate students, a critical component to our success. Salary and tuition costs exceed $33,000 annually for each student; in order to attract and retain the best and the brightest, we need your help to meet this growing expense. Your generous donations are greatly appreciated.

www.biology.uiowa.edu/alumni_giving.php

OBITUARIES

(Birth names in parentheses)

Ash, Wallace H., M.D.; B.A. (Zool) '49.

Baker, G.E., Ph.D., M.S. (Botany) '32.

Clodfelter (see Lucke).

Davis, Thomas M., Col., B.A. (Zool) '52.

DeHamer (see Gordon).

Foote, Florence M., Ph.D. (Zool) '40.

Gordon, Melinda K. (DeHamer), B.A. (Biol) '93.

Hotka, Ray, M.S. (Zool) '42.

Hunter, C.T., B.A. (Zool) '27.

Kritzler, Henry, Ph.D. (Zool) '42.

Linsky, Alvin J., B.A. (Zool) '42.

Liu, Rugao, M.S. (Biol), '92.

Lovejoy, Eunice S., M.S. (Botany) '31.

Lucke, Henrietta (Clodfelter), M.S. (Zool) '49.

Nelson, Herman L., M.S. (Zool) '39.

Markey, Mary E., B.A. (Zool) '48.

Morgan, John R., B.A. (Botany), '48.

Regnier, Arthur

Vincent, Jr., M.S. (Zool) '41.

Rosen, Walter G., Ph.D. (Botany) '51.

Sevcik, Randy A. M.D., B. S. (Biol) '89.

Turpin, Jean Martin, B.A. (Botany) '38.

Walker, J. Fredrick, Ph.D. (Zool) '35.

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Julie Rogers
Thomas Koeppel

CONTRIBUTORS

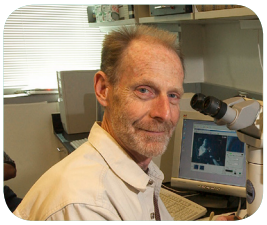
Bernd Fritzsch
Jonathon Poulton
Alan Kay
Mike Dailey
Eugene Spaziani

THANK YOU

The Department of Biology wishes to extend a very heartfelt thank you to all those who have assisted us and the rest of The University of Iowa through the flooding this summer and the rebuilding effort needed to continue as a world renown academic and research institution!

CELEBRATING RETIREMENT

DECEMBER 2007



Jack Lilien worked with us for 7 years as Chair of the Biology Department. His energy and vision renewed the Department's vitality, it cohesiveness, and its scholarly aspirations. He developed a strong relationship with the Roy J. Carver Charitable Trust, which has generously supported our Carver Center of Comparative Genomics and the research of several individual faculty members. Jack's high energy kept us on our toes and propelled us into being forward thinking. Thanks Jack!

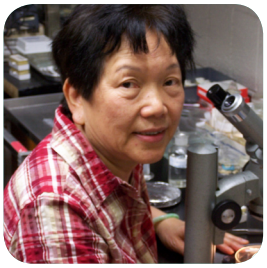
Janne Balsamo worked with us for 7 years as a Research Scientist in the Lilien lab and operated as Jack's partner in research. Janne was indispensible as the leader of the lab group supervising personnel and projects. She was Co-Principle Investigator on most of the grants that funded research in the lab and contributed to nearly all of the publications that resulted from that research. Janne also contributed to teaching in the department as she team taught in several courses. She was a very pleasant person to know and had a very calming effect on the people around her. We wish you the best in your retirement Janne!

Rebecca Reiter worked within the Department for 38 years. Becky worked for 2 labs in the department, the first was Dr. Michael Solursh until he passed away in 1994. Becky then moved to Jim Lin's lab where she made a strong impression on Jenny Lin who had this to say, "She taught me so much in her 13-14 years in the Lin lab. She was nice to everyone and worked well as a team member." Her contribution to the department and University are immeasurable. Happy retirement!

Bill Page worked in the Lilien lab for 7 years. He was a great asset to the lab and has a quiet demeanor and wit. Happy retirement!

JUNE 2008

Barbara Stay has been known in many ways. She is the bike lady, the bug lady but most of all she is a beloved colleague and friend. She came to the University of Iowa in 1967 as an Associate Professor and has taught courses in Animal Biology and Insect Reproduction and Development. Barbara has decided it is time to leave us and she will be sorely missed! Though her research will keep her here for another year, she will no longer teach the basic Animal Biology course to non-majors. We wish her well in all of her future endeavors!



Kuen Kuen Chan has worked with Barbara Stay in her lab for several years. Her speciality in the lab has been the immunostaining and microscopy which she has done for 28 years. Her love of keeping busy, ability to see what needs to be done and speed of doing it have made her an indispensable member of the Stay research team. Kuen Kuen has helped many people in different ways. She is very personable and is a great listener. She always thinks positively and is energetic. We wish her well during all her travels!

FACULTY SPEAKER INVITATIONS

D. Bhattacharya presented no less than 12 invited lectures at 8 domestic institutions, and foreign scientific groups in Canada, Spain and Germany. He also gave the invited symposium papers, "Endosymbiotic gene transfer and plastid origin in chromalveolate protests", Annual meeting of Botanists.

M.E. Dailey gave the platform lecture at the 4th Omaha Imaging Symposium, Creighton U., in September '07, and spoke at the 9th International Neuroscience Winter Conference, Sölden, Austria (March '07).

D.F. Eberl gave a talk, "The sound of one wing flapping: Hearing mechanisms in Drosophila", to the Committee on Cell Physiology. U. of Chicago, IL

J. Fassler gave invited seminars at the Wake Forest U School of Medicine (Biochemistry Dept.), Winston-Salem, NC, U. of N. Carolina (Biology), Greensboro, NC, and at the Columbus Children's Research Institute, Columbus, OH. She also gave a symposium talk at the Gordon Conference on Signal Transduction in Microoganisms, Ventura, CA.

S.H. Green gave a paper at the national symposium, Structural and Functional Organization of the Synapse, "Synaptogenesis in the auditory cortex", held in Iowa City, June, '07.

S.D. Hendrix gave a symposium talk, "The effects of local and landscape features on diversity of solitary bees in tall grass prairie fragments," at the Botanical Society of America meeting in Chicago, 2007.

D. Horton made a presentation to the 31st Loess Hills Prairie Seminar, "Rochester Cemetery: A legacy of pre-settlement landscape.

D.W. Houston gave a talk to the Society for Developmental Biology Mid-west regional meeting, "Regulation of nodal signaling by maternal factors in Xenopus", Chicago, IL.

A. R. Kay presented invited talks to the Depts. Of Biochemistry, Kings College, London U., UK, and Chemical Pathology, U. of Stellenbosch, South Africa, and to the Mental Health Research Institute, U. Melbourne, Australia. He also gave the talk, "Metals and membranes in neuroscience" at the 7th International Brain Research Organization satellite symposium, Melbourne, Australia, July '07.

J. J.-C. Lin gave the lecture, "Can mXina, an intercalated disc protein, knockout lead to cardiomyopathy with conduction defects?", to the Institute of Physiology, National Defense Medical Center, and to the Dept. of Pharmacology, National Taiwan U. School of Medicine, both in Taipei, Taiwan, and to the Cardiovascular Center of the U. of California San Diego, La Jolla.

J.M. Logsdon gave an invited paper, "Molecular natural history of the meiotic recombination machinery (and the origin of sex)", to the annual meeting of the Society for Molecular Biology and Evolution. He also presented the paper, "Sex, cells: The origins and evolution of meiosis", at the U. of New Hampshire, and to the Bay Paul Center, MBL Woods Hole, MA.

B.F. McAllister gave two seminars in 2007 at the U. of Arizona: "Divergence between X and Y chromosomes: Evidence of selection in response to sex-linked transmission", to the Ecology and Evolutionary Biology Dept., and "The Drosophila virilis species group", to the Drosophila species workshop, Tucson Stock center. He also gave the invited talk, "An X-centric perspective on sex chromosome evolution in Drosophila", to the Mid-West Drosophila Conference, Allerton, IL.

J.R. Menninger presented a seminar, "Big loser codon pairs in E. coli have normal usage in other genomes", at the Center for Pharmaceutical Biotechnology, U. of Illinois, Chicago.

D.R. Soll gave invited talks at five venues in 2007: The 4th annual Advanced Optical Methods Workshop, Berkeley, CA; A Gordon Conference on Cell Signaling and Directional Motility; a workshop on Host-Pathogen Interactions, Cold Spring Harbor, NY; the Colloquium, "The Fungal Kingdom: Diverse and Essential Roles in Earth's ecosystem", Amer. Academy of Microbiology, Tucson, AZ; the Institute for Physics and Biology, U. California San Diego, CA.

C.-F. Wu gave invited national and international presentations: The 11th European Symposium on Drosophila Neurobiology, Wuerzburg, Germany; The 5th International Neuroscience Symposium in China, Changsa, China; Symposium on Habituation, U. of British Columbia, Vancouver, Canada; and the CSHL meeting on "Neurobiology of Drosophila", Cold Spring Harbor, NY.

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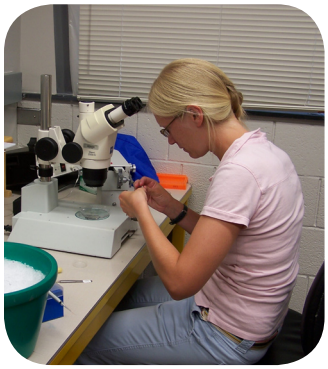

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