

Department of **BIOLOGY** NEWSLETTER



RESEARCH AND TEACHING

THE INSEPARABLE FUNCTIONS OF THE UNIVERSITY

This is a particularly pertinent time to be focusing our newsletter on evolution. We are experiencing one of our recurrent periods of public controversy surrounding this discipline and there is a resurgence of attention on the teaching of evolution in the K-12 science curriculum. The Department of Biological Sciences is committed to a strong and vibrant research program in Evolutionary Biology as it is one of the unifying principles of all biology.

The concept of Evolution as originally articulated by Darwin and Wallace, descent with modification acted on by natural selection is, like Atomic Structure, Genetics or even Gravitation, a scientific theory based on data accrued through the rigorous application of the scientific method: observation coupled with hypothesis formulation and experimental testing.

Evolutionary processes occur on a continuum where individual random changes in DNA create a reservoir of usually small differences among organisms within a population, and this variation faces the ever-present sieve of natural selection as it is transmitted to the next generation. Through this process small, initially unperceivable changes accrue in separated populations, but ultimately over time, these accumulated differences give rise to new species and these new species may eventually spawn entirely new realms of biological diversity.

In the past six years, four faculty members with primary research interests in the field of evolutionary biology have joined the department, and a new recruit, **Maurine Neiman** will be joining the department in Fall 2008. This brings the number of faculty doing basic research in this critical area to seven, with additional faculty involved in teaching. The growth of our group of evolutionary biologists has been greatly enhanced by grants from the Roy J. Carver Trust. Their funding has allowed us to set up the **Roy J. Carver Center for Comparative Genomics (CCG)** and to develop the instrumentation base

essential to modern research in this highly competitive area. It has been through studies comparing the genomes of organisms in all three kingdoms and representing most of the distinct phyla that we have gained tremendous insight into the evolutionary history of many of the diverse organisms that populate our planet. And it is with high throughput genome sequencing that many, if not all of our evolutionary biologists are pursuing an understanding of the mechanisms through which this diversity has been generated.



A male *Potamopyrgus antipodarum* (blue) pursues a mating opportunity with an asexual female (pink). Surprisingly, male *P. antipodarum* do not discriminate between mating with sexual vs. asexual females, though males get no genetic benefits from mating with asexuals. Asexual *P. antipodarum* also get no benefit from mating with males, but do so freely, perhaps a reflection of their recent descent from sexual ancestors.

The newest member of our Evolution group, **Maurine Neiman**, focuses her research program on why sexual reproduction is so common. This is truly one of the greatest mysteries in evolutionary biology as all else being equal, asexual females will produce twice as many daughters as sexual females and this ought to logically result in the selective elimination of sex. Despite this, sex is ubiquitous in nature to the extent that many of

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FALL 2007

FROM THE CHAIR



Dear Alums and Friends,

Two events dominate my note this year: first and most recent is the death of Jerry Kollros on June 8, 2007. Jerry was chair of Biological Sciences, originally Zoology, from 1955 to 1977 and retired in 1988. Jerry had been coming to work almost every day since that retirement, come rain or snow or the heat of summer. Donations from Jerry's students and colleagues helped fund the outfitting of the lecture hall in the new Biological Sciences Building and in 2001 the room was officially dedicated in his honor. I have a special connection with Jerry. Many of you know that scientists take pride in their "family" trees, and Jerry and I discovered, soon after I arrived here, that we are branches on the same tree. In fact, we did our Ph.D. work at the same bench in the same room of the same building at the University of Chicago. We are both legacies of the same tradition in Neurobiology. Jerry's mentor was the well-known pioneering neurobiologist Paul Weiss and my mentor, Aaron Moscona, took over the same laboratory space years later, addressing many of the same research questions. This connection to Jerry has been a real source of pleasure to me and, I think, to Jerry.

Jerry asked that, in lieu of flowers or other personal remembrances, donations be made to the Biological Sciences Graduate Fund. Donations can be made in Jerry's name. He was extremely generous in supporting the growth of the graduate program and, as you have read in this column many times, this fund is our greatest single need.

The second event is my retirement. My partner, Janne Balsamo, and I decided that this would be our last year in academia. We have been in an academic setting our entire careers and have worked together most of that time. Our research together began by asking the very fundamental question, what is the molecular nature of the "glue" that holds cells together in multicellular organisms and how does that "glue" allow for the many cell rearrangements that are essential to convert a group of initially very similar cells into the many diverse cell types organized into the discrete tissues and organs we recognize as familiar. Our efforts always focused on neuronal tissues – eye and brain – and began to focus some years ago on how this "glue" might be involved in guiding the neuronal extensions that are essential to connect neurons and establish patterns, the axons and dendrites, to their ultimate destinations. I hope we have been able to make a contribution to this exciting and expanding area of research.

My years as chair of the department have been the high point of my career. My faculty colleagues, the incredible support staff, and the students have made my tenure as chair very productive and a great pleasure. The shared vision, mutual support and collaboration of the entire department have made possible a period of growth and development. I look forward to watching the department grow and prosper as a new chair takes over the reins.

Sincerely,

Jack Lilien, Ph.D.
Professor & Chair

A SEARCH FOR A NEW CHAIR

Hiring Jack Lilien to head the Department of Biological Sciences is among my proudest achievements as Dean of Liberal Arts & Sciences at Iowa. As a biologist myself, I recognized the talent and potential of the Department when I came here ten years ago. As a former chair of a biology department (at Penn State), I also saw the need for a leader with a fresh perspective and the highest standards who could guide the Department to even higher levels of achievement.

A lucky seven years ago, with the strong support of the faculty, I hired Jack Lilien to fill that role. Jack's energy and vision have renewed the Department's vitality, its cohesiveness, and its scholarly aspirations. He brought the Department into the top 25 biology departments in public institutions nationwide within his first five years as DEO.

Jack has hired an impressive group of young faculty across the Department's focal areas of Neurobiology, genetics, evolution, and cell/development. He has mentored his faculty as they have established important new courses for undergraduates and graduate students, most recent a laboratory course in Neurobiology. He has also mentored the younger faculty in building outstanding research programs that have increased the Department's total external funding. In Jack's term as DEO, the average number of research dollars awarded to the Department each year has increased by almost 40% over the average for the previous seven years—a striking achievement in such a short period of time.

Jack 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, particularly junior faculty. In addition to advising the younger members of the Department on grant applications, Jack has led by example. In 2005-06 he obtained more than \$1 million in funding for his own research program, earning himself membership in an elite group of researchers at The University of Iowa.

Jack has begun important outreach efforts to keep alumni connected to the life of the Department. He has also worked with David Soll, our Emil Witschi-Carver Professor of Biology, to lay the foundation for a secure resource base for graduate student funding far into the future. Departments with lab-based faculty are complex to administer because of the array of personnel, equipment, and funding on which each laboratory depends. Along with the Department's excellent staff, he has set high standards for administrative effectiveness and responsiveness.

I am very reluctant to see Jack leave our campus. But I am confident that the vision and esprit he has created will attract a successor who will take the Department to an even brighter future.

DEDICATION TO UNDERGRADUATE TEACHING

Undergraduate teaching is at the center of our departmental mission and in this brief article I want to highlight the efforts of three of our dedicated teachers. But first to give some perspective to our undergraduate teaching mission I'll throw out some data. We teach about 50 undergraduate courses each year; this amounts to about 5000 students and 17,000 credit hours. We have about 700 departmental majors and graduate about 100 students per year with degrees in Biology. Many of our undergraduate students continue on to further their education in various fields. They may well become the next generation of teachers and working scientists.

Three of our senior faculty members, Barbara Stay, Joseph Frankel, and Gary Gussin, have played particularly important roles in fulfilling our teaching mission and have all taught large introductory courses over their many years in the department.

Barbara Stay came to the University of Iowa in 1967 as an Associate Professor. She received her Ph.D. at Radcliff Graduate School of Harvard University. She was a Fulbright Scholar in Canberra, Australia, a Lalor Fellow at Harvard, and is a Fellow of the American Association for the Advancement of Science and the Entomological Society of America. She has been the Principle Instructor for Introduction to Animal Biology, a course taken by non-biology majors. She has also taught Insect Reproduction and Development, a more advanced course in her area of expertise. She has mentored many Honors Students and 6 Ph.D. students. Her undergraduate teaching evaluations have consistently rated her very highly and student comments such as: "The class was difficult but prepared me most for harder classes in the future", "I thought she was great. She pushed me to work hard at understanding the material", "Dr. Stay obviously loves the subject matter and it shows in her lectures", reflect her rigor and style.

Joe Frankel came to the University of Iowa in 1962 as an Assistant Professor. He received his Ph.D. from Yale followed by Post Doctoral study at the Biological Institute of the Carlsberg Foundation in Copenhagen, Denmark. He is a Fellow from the American Association for the Advancement of Science. He has been the Primary Instructor in Principles of Biology, the first course taken by Biology majors, for many years. He also teaches Introduction to Developmental Biology and an advanced course in developmental biology, Genes and Development. Joe has also mentored 12 Ph.D. students. Undergraduate students have commented on Professor Frankel's teaching saying that: "You inspired me to be a biologist", "Professor Frankel is an awesome teacher. He seems so passionate about what he is teaching. He makes me want to pay attention in lecture", and "Teaches very effectively, I was so excited and honored to have him as a teacher".

Gary Gussin came to the University of Iowa in 1969 as an Assistant Professor. He received his Ph.D. from Harvard University, followed by Post Doctoral study at Stanford University, and at the Institute for Molecular Biology at the University of Geneva, Switzerland. He has been the Primary Instructor in Fundamental Genetics, one of our most challenging undergraduate courses which is required by all our undergraduate majors and our graduate students. He also is one of the primary instructors in Human Genetics, a general education course for non majors. Gary's primary research is in the genetics of bacterial viruses and he mentored 7 Ph.D. students over the years, many of whom have gone on to faculty positions at other universities. Professor Gussin consistently receives comments such as: "Gary does a good job of putting the material into perspective to make it more understandable", "Dr. Gussin has a challenging but fair class", and "This class is very enjoyable. I learned many new and interesting things".

These three professors have, over many years, consistently risen to the challenge of communicating difficult material to large classes. Furthermore, the students in these courses are getting their first taste of college level science; they are a difficult and demanding audience. Barbara, Joe and Gary, along with their colleagues, form the cornerstone of our program and set the standard for excellence.

UNDERGRADUATE FIRST YEAR SEMINARS

Each semester, a faculty member teaches a seminar for undergraduate students. Much of the seminar series requires students to write and critique articles research scientists have written in a field chosen by the teaching professor. One of the biggest challenges is to get students to understand how to critique articles that are relevant to the course. The course is designed to teach students how to write in a scientific manner. The students write a major paper using research done through the series of articles. Writing an original work can be difficult, but it is an essential skill when doing their own research later.

SPRING 2007

John Logsdon

Evolutionary Biology

Sex is one of the unsolved mysteries in biology. Why do organisms have sex when other alternatives for reproduction are possible and simpler? In this seminar, the importance of sex in the evolution of life on earth and its very curious consequences for biology are discussed. The sex lives of a wide variety of organisms ranging from bacteria to humans will be considered through the lens of evolutionary biology. Following a brief introduction to evolutionary thinking, a broad range of topics on the biology of sex will be explored through discussion of readings from a few scientific articles and numerous popular sources. This course will include research seminars from prominent scientists working on the evolution of sex. By attending these seminars and meeting with the speakers, students will experience first-hand some of the excitement and discovery of science.

FALL 2007

Douglas Houston

Developmental Biology

In recent years, science has seen enormous advances in the understanding of embryonic development: the process of how a single cell (the egg) can generate a complex organism with many functional cell types. Developmental Biology has illuminated numerous aspects of modern science, from our understanding of animal evolution, to health related applications, such as in vitro fertilization and the use of stem cells, which have the ability to develop into many different cell types. This seminar aims to give students interested in a Biology-related major a basic understanding of Developmental Biology, as it relates to the topics of evolution and stem cells. This seminar is not intended as an ethics forum on these topics, but rather to teach the science behind them and to allow students to formulate an educated opinion. The course material will consist of readings of recent popular science books and articles, as well as demonstrations using living embryos.

CONGRATULATIONS GRADUATES OF BIOLOGY

Ph.D.s

Jason Caldwell

Fall 06 (Eberl Lab)

"Characterization of chordotonal dysfunction in *Drosophila melanogaster*"

I-Feng Peng

Fall 06 (Wu Lab)

"Genetic and physiological analyses of neuronal electrical activities and development in cultured *Drosophila* central neurons"

Robbin Eppinga

Spring 07 (Lin Lab)

"The roles of tropomyosin, caldesmon and myosin Va in non-muscle cell motility"

Sandhya Shankarnarayan

Spring 07 (Fassler Lab)

"A potential role for the cell wall in the regulation of the SLN1-SKN7 pathway in the yeast *Saccharomyces cerevisiae*"

Tetyana Nosenko

Summer 07 (Bhattacharya Lab)

Chromalveolate genome evolution"

Ter-Yun Timothy Lin

Summer 07 (Shih Lab)

"Genetic and molecular analyses of Arabidopsis signaling mechanisms in response to environmental stresses"

Shehre Banoo Malik

Summer 07 (Logsdon Lab)

"The early evolution of meiotic genes"

M.S.s

Glenn Morse (Logsdon Lab)

Michael Peglar (Bhattacharya Lab)

Joshua Strable (Irish Lab)

Xuxuan Adam Wan (Wu Lab)

Min Wu (Bhattacharya Lab)

Jing Yuan (Logsdon Lab)

FACULTY ACTIVITY NEW GRANTS

D.Bhattacharya was awarded an NSF grant "The complete genome sequence of the glaucophyte alga *cyanophora paradoxa*".

M.E. Dailey was awarded a 2-year grant from the American Heart Assoc., "Mechanisms and consequences of CaMKII targeting in hypoxia-induced synaptic remodeling." He also won a short-term grant, "Investigating the molecular mechanisms of schizophrenia, from the Nellie Ball Trust Research Fund.

D.F. Eberl received a five-year grant from the NIH, "*Drosophila* deafness genes: Analysis of chordotonal organ function."

L. Hadany has received a two-year research grant from the NSF, "Towards a general theory of fitness- associated genetic mixing."

S.D. Hendrix received a 1-year grant (with F. Candelaria) from the Iowa Science Foundation to study "Dispersal of insect herbivores in fragmented landscapes: Merging empirical and modeling studies", and another from Prairie Biotech Research for "Nesting resources for bees in fragments habitats."

D.W. Houston was awarded a 3-year grant from the R.J. Carver Charitable Trust, "Control of nodal growth factor activity in vertebrate development."

J.M. Logsdon is the recipient of a 3-year grant from the Roy J. Carver Charitable Trust, "A phylogenetic analysis of sex and meiosis in fungi.

B.F. McAllister is a subcontracting collaborator on a grant from the NSF Division of Environmental Biology, Population and Environmental Processes, "Genetic basis of pigmentation evolution in *Drosophila* (DEB)". PI: P.J. Wittkopp.

D.C. Slusarski has been awarded a grant from the BAI Innovation Fund as co-PI with V.C. Sheffield, for a "High-Throughput Animal Model Facility". She is also Co-PI in two long-term grants awarded in early 2007 from the NIH, "Interdisciplinary approach to retinal disease gene identification" and "Evaluation of complex inheritance of retinal degeneration in Bardet-Biedl syndrome."

D.R. Soll received a one-year continuation of funding for the Developmental Studies Hybridoma Bank, Institute of Child Health and Human Development, NIH.

C.S. Stipp is the recipient of three grant awards: "Novel mechanisms regulating integrin trafficking in migrating tumor cells", 3 years from the Amer. Cancer Soc.; "Exploring the potential alpha integrin subunit hinge domains as a novel class of cell-surface therapeutic targets in prostate cancer", 2 years from the Department of Defense; "Regulation of integrin-cadherin crosstalk by tetraspanin CD151", 3 years from the Roy J. Carver Charitable Trust.

J. A. Weiner. His research, "Cell adhesion molecules in synapse formation: Roles of the gamma-protocadherins," received 2-years of support from the Basil O'Connor Starter Scholar Research Award, March of Dimes, 3-year Roy J. Carver Charitable Trust "The control of CNS synapse development by glial gamma-protocadherin adhesion molecules", NIH 5-year grant "Elucidating functions of the gamma-protocadherins in CNS synapse development."

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

J.M. Comeron was appointed to the NSF's 2006 Doctoral Dissertation Improvement Grant Advisory Panel.

E. Irish served on the NSF panel on the Plant Genome.

J.M. Logsdon was elected Chairman of Division 10 (Molecular, Cellular and General Biology of Eukaryotes) of the American Soc. of Microbiology.

C.-F. Wu served on the following NIH Study Committees as ad hoc member in 2006: NTRC; NDPR, MDCN-7; and the NTRC.

JERRY J. KOLLROS (1917-2007)



He taught many of our courses through the years, including his specialties, development and neurodevelopment, but his special love was comparative vertebrate anatomy. He assembled masses of enrichment materials for this course and delighted in informing students of the arcana of animal structures that so resembled their own. Students who went on into the biomedical professions often wrote to him expressing appreciation for the solid foundation that he had provided.

His subsequent administrative/scientific contribution was to help gather like-minded neuroscientists across campus to obtain one of the first Program Project Grants from the NIH.

This issue of the newsletter is dedicated to Professor Jerry J. Kollros who died on June 8, 2007 after a long battle with cancer. He was 89. Dr. Kollros was a native of Vienna, Austria, but lived as a boy in what is now the Czech Republic. His family emigrated to America in 1919 and settled in the Chicago area. Dr. Kollros showed early signs of academic promise and won a scholarship to the University of Chicago, from which he received the B.S. degree in 1938 (Phi Beta Kappa). He proceeded to the Ph.D. degree there (1942), studying development with Paul Weiss (See "From the Chair", P. 2 for a related historical note).

Under Dr. Kollros' leadership, the department more than doubled in size in the 1960's and early 70's.

During the remainder of the war years, Dr. Kollros was engaged in war-related research dealing with head injuries and concussion as well as epileptogenic effects of penicillin. In this period he married fellow graduate student, Catherine Lutherman (Ph.D., U. of Chicago, 1944). There followed a faculty appointment in Zoology at the University of Iowa (1946) and he rose rapidly to the full professorship by 1957. Meanwhile, he served as Acting Chairman of the Department and then Chairman (1955), while still an Associate Professor. Dr. Kollros served as Zoology Chairman for 22 years, having been re-elected enthusiastically by his colleagues to successive terms.

His research was devoted to neurodevelopment in amphibians; he was especially fascinated by what could be revealed during metamorphosis in these animals, which change dramatically in structure and function from an aquatic tadpole to a terrestrial form, all controlled by the thyroid hormone. He found he could effect these changes conveniently by adding the hormone directly to the aquarium water (1963). In the course of this work he made three major, much-cited contributions to the field. First, he devised a method (with A.C. Taylor, 1946) for breaking up the rapid development of the frog into arbitrary, but well-defined stages. This staging scheme was quickly adopted by amphibian biologists as it enabled them to compare accurately their work across labs. Next, he showed that thyroid hormone could act directly on the brain to cause its maturation. This was the first demonstration that hormones control the development of the brain in vertebrates. Later, Dr. Kollros and colleagues discovered that the nervous system undergoes remodeling during development, involving nerve cell turnover (cell death and replacement). He was among the first to realize that a strategy used in development is to overproduce cells to make certain that the appropriate networks form and then to eliminate those not needed.

His talents extended to administration. Under Dr. Kollros' leadership, the department more than doubled in size in the 1960's and early 70's. He first acquired funds from the state and a facilities grant from the NSF to construct Zoology Addition I (1965). He was among the leaders in organizing and obtaining a multi-million dollar

Centers of Excellence grant from the NSF, which provided for our interdisciplinary Biological Sciences Development Fund. This grant financed the strengthening of three targeted areas: Genetics, endocrinology and neurosciences (1967-1972). The grant also defrayed costs of remodeling the Zoology Annex to provide research space for our burgeoning faculty. The expansion continued with the construction of Zoology Addition II, financed with a grant from the NIH, that provided space for specialized, jointly-used research equipment, as well as for several state-of-the-art teaching laboratories (completed in 1971). Starting the 1971-72 academic year, Zoology extended around two sides of the block bordered by Jefferson and Dubuque Streets, as well as the block's interior.

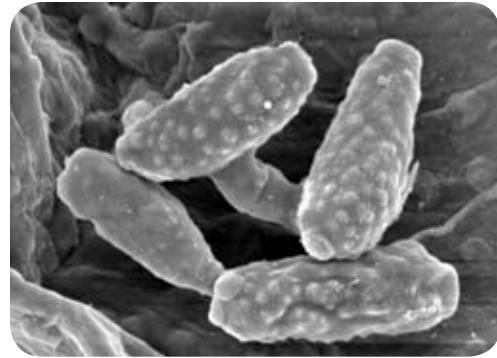
His subsequent administrative/scientific contribution was to help gather like-minded neuroscientists across campus to obtain one of the first Program Project Grants from the NIH. This supported research around the theme, generation of nerve cell form and function. Dr. Kollros took over as Principal Investigator of the grant in 1983 and led it through a renewal. In his academic career, he guided 24 students to the Ph.D. and 32 to the M.S. degree. To recognize his many achievements, the Biology auditorium in the newest of our buildings (Biology Building East) was named in his honor (2001).

Dr. Catherine Kollros preceded her husband in death. They are survived by two sons, James and Peter; daughter-in-law Barbara and two grandchildren, Daniel and Catherine. He will be sorely missed by his immediate family, his academic family and the scientific community.

RESEARCH AND TEACHING

Continued from cover

the fundamental features of eukaryotes (e.g. distinct chromosomes, meiosis, and the union of gametes to form a unicellular zygote) revolve around sex. Maurine's research uses *Potamopyrgus antipodarum*, a freshwater snail native to New Zealand. This snail is of particular interest because sexually-reproducing females occasionally produce asexual female offspring. Given that asexuals produce twice as many daughters, one would predict that only asexual snails would remain. The fact that sex has managed to persist in this species indicates that sexual and asexual *P. antipodarum* must differ in ways other than reproduction. Maurine seeks to understand what these differences are using genetic, ecological, molecular, and behavioral approaches.



Candida mating on mouse skin

David Soll is one of our most senior faculty members and his large group focuses in several areas evolution included (You may recall a description of his research program in Cell and Developmental Biology in a previous issue of our yearly Newsletter). The Soll laboratory is interested in all aspects of the biology of *Candida albicans*, the major human yeast pathogen. Earlier experiments analyzed the evolutionary history of *Candida albicans* isolates from all over the world, but their more recent work has focused on sex. They discovered that the genes that dictate whether *C. albicans* is male or female are also involved in the capacity to cause disease. This led to the hypothesis that the sexual system, which is rarely used by *C. albicans*, and thus ought to have been eliminated, has been maintained during the rapid evolution of the organism, not because of selective advantage for its role in mating, but because of selective advantage for its role in pathogenesis. These exciting new insights are supported by recent experiments using a mouse model for bloodstream and organ infection by *C. albicans*.

Debashish Bhattacharya's laboratory pursues several different but related research areas; however, the primary question is when and how primordial cells acquired the membrane enclosed organelle from which plants derive their energy and green color – the chloroplasts. This is one of the key events that distinguish bacteria (prokaryotes) from other organisms (eukaryotes – plants, animals, fungi, protozoans),

the presence of membrane enclosed intracellular organelles, chloroplasts and mitochondria. The other of course is the presence of a membrane enclosed nucleus. Bhattacharya has contributed immensely to pinpointing the essential event, the engulfment of a photosynthetic bacterium by a larger predatory cell and its eventual enslavement by the parent organism.

The Bhattacharya laboratory is also deeply involved in the NSF sponsored Tree of Life project. This project aims to erect a genealogy of eukaryotes. This is a large program taking place in many laboratories across the U.S. In fact, John Logsdon (see below) is also involved in this project. A part of the laboratory's efforts are devoted to the biology and genomics of "red tide". Red tide is caused by *Alexandrium tamarense*, a unicellular protist that causes paralytic shellfish poisoning (e.g., June, 2005 red tide off the coast of Massachusetts). The impacts of this organism on marine ecosystems and the seafood industry are substantial due to damage to commercial fisheries and the toxins produced by it are suspected as a cause of mortality in sea birds and humpback whales and human intoxication and death.

John Logsdon is also part of the Tree of Life project aiming to understand the evolutionary origin of the differences between prokaryotic and eukaryotic cells and to build a robust phylogenetic tree of eukaryotes which will provide the critical framework essential for making evolutionary comparisons among eukaryotic species, genomes and genes. His laboratory also focuses on the eukaryotic-specific process of meiosis: the specific type of cell division that creates reproductive cells (e.g. sperm and eggs) with half the complement of genetic material. The long-term goal is to systematically document the presence and analyze the evolution of all the genes involved in meiotic processes. Information about the evolutionary histories of meiotic genes in eukaryotes will then be used to trace the origin of meiosis and to shed light on the evolution of sexual reproduction itself.

Josep Comeron studies the evolution of genes and genomes by studying DNA variation within and between species. The objective of these studies is to detect the effects of natural selection on preserving or eliminating the random mutations that occur in the genome even when the consequences of these mutations on fitness are too small to measure. The laboratory combines large-scale DNA sequencing, comparative sequence analysis and computer simulations of the evolutionary processes. Research focuses on mutations giving rise to synonymous changes, changes in the DNA sequence that do not change the protein sequence. For years, these mutations had been assumed not to play a role in natural selection but recently they demonstrated that these mutations are in fact under natural selection in humans; therefore, they should be taken into account not only in evolutionary analyses but also

as potential causative mutations in association studies of genetic diseases.

In collaboration with Dr. Ana Llopart, Josep's lab has turned its attention towards the formation of new species using the fruit fly *Drosophila* as model organism. Analyses of DNA and protein variation combined with studies of differences in gene expression between very closely related species are allowing them to unravel the basis of morphological changes and adaptation to new habitats.



Graduate student Yasir Ahmed sorting flies in the mobile McAllister lab. Following collections from baits of fermented bananas, flies are anesthetized with CO₂ and sorted into individual vials in the field.

Research in **Bryant McAllister's** laboratory also uses the fruit fly *Drosophila* as a model organism, but the analyses deal with very large scale changes in genome organization at the whole chromosome level. A rather dramatic example of such a rearrangement is the focus research in the laboratory. In one particular species, *Drosophila americana*, an entire chromosomal arm has been fused with the X chromosome (one of the two sex chromosomes). The frequency of this rearranged chromosome in populations throughout the Mississippi River Valley exhibits a strong positive correlation with latitude and natural selection acting through climatic variation explains the distribution of this rearrangement. One consequence of this rearrangement is that a previously autosomal (non-sex chromosome) region of the genome is now sex linked. In other words, male flies in northern populations (such as around Iowa City) transmit about 1/5 of their genome linked specifically with transmission of the X sex chromosome, whereas male flies in southern populations transmit this same chromosomal region to daughters and sons unlinked to sex. Sex-linked transmission is causing rapid change in this genomic region, and quite surprisingly, most of this change appears to have occurred as a consequence of selection specific to female flies.

In place of actual biological organisms, **Lilach Hadany**, who also has an appointment in the Department of Mathematics, uses analytical models and computer simulations to try to understand the forces that drive genetic variation, the patterns of variation expected in natural populations, and the evolutionary consequences of these patterns. Modeling has revealed the possibility that, contrary to the general assumption that the amount of genetic variation introduced at each generation is uniform. Her research has uncovered an alternative hypothesis: that the amount of genetic variation introduced depends on the state of the organism,

FIRST ANNUAL GRADUATE STUDENT RETREAT

The First Annual Biology Graduate Program Retreat took place on Saturday, November 4, in Dubuque, and was a fantastic success. This is thanks to a great turnout, excellent keynote speakers, wonderful student poster sessions, and the organizational efforts of the Graduate Recruiting, Retention, and Admissions Committee (GRRAC) along with our team of office staff. Ninety-eight graduate students and faculty made the trip in lovely autumn weather to the event site, the Holiday Inn Dubuque/Galena, which represents a turnout of nearly 100%.

The day began with pastries and coffee, followed by an excellent keynote talk by Dr. Elizabeth Raff, Chair of the Biology Dept. at Indiana University, on her lab's genetic analysis of microtubule dynamics in *Drosophila*. One of two highly interactive student poster sessions followed, at which people enjoyed scientific and social conversations while munching on lunch from the Mexican buffet. The afternoon began with 30 minute talks by four of our own distinguished faculty members: Jack Lilien, David Soll, Steve Hendrix, and Bob Malone. The breadth

of departmental research really came through in these talks and in the student poster sessions, a second installment of which followed. Nearly 40 posters were presented in all, a fantastic showing in a department of ~60 graduate students, and a testament to the enthusiasm that the event generated. Finally, the scientific portion of the Retreat ended with a talk by Dr. Antony Stretton of the Dept. of Zoology at the University of Wisconsin, where he discussed not only his research on neuropeptides, but also gave a fascinating overview of his historic work alongside founders of modern molecular biology such as Francis Crick and Sydney Brenner.

After a long day of intense scientific activity, our intrepid Retreat attendees were ready to party--and party they did at the beautiful National Mississippi River Museum and Aquarium, a Smithsonian Institution site that is Iowa's #1 attraction. A delicious buffet dinner and various liquid refreshments accompanied more socializing amidst spectacular exhibits of fish, snakes, alligators, turtles, and other river denizens. At the dinner, prizes were awarded to

those students whose posters had received the most votes in a "Best Poster Contest": The first-place prize of a \$75 Iowa City/Coralville Gift Certificate went to Fu-Chiun Hsu, a member of Ming-Che Shih's lab; the second-place prize of a \$50 Gift Certificate went to Sara Sheeley, of Bryant McAllister's lab; and there were so many great posters that the third-place prize was a four-way tie between KariAn Lee (Fassler lab), Elisabeth Gustafson-Wagner (Lin lab), Paulina Mena (McAllister lab), and Robbin Eppinga (Lin lab). Much witty repartee could be overheard at the museum, as well as the casual after-party carousing at the nearby Busted Lift pub, and a great time was had by all.

Thanks to all attendees and organizers for making this an event that we plan to make into a yearly tradition! Special thanks should also go to our generous sponsors, who helped finance the Retreat: Fisher Scientific, Kimberley-Clark, IDT DNA Technologies, North Central Instruments/Leica, and Capanna Coffee and Gelato.

such that individuals under stress have greater variation. According to this theory, a population of wolves living in extremely cold and nutrient-sparse conditions would be expected to react to such stress by introducing a greater degree of genetic variation between their progeny than would their cousins living in more welcoming surroundings. This gives natural selection additional raw material from which to select those that are best suited to the harsher environment. These types of studies may improve our understanding of how populations react to a changing environment, an issue of critical importance in conservation biology and specifically relevant to global warming. Her research may also have human health implications by providing new insights into the apparent increase in drug-resistant pathogens.



Solidago Gall Dissected

Research in **Steve Hendrix's** laboratory addresses the evolution and ecology of plant-animal interactions. His ecological studies focus on solitary bee pollinators in prairie remnants and the surrounding landscape features that affect bee diversity. The importance of wild bee pollinators has recently been in the news as the populations are dwindling and this is having tremendous ramifications on commercial produce. In spite of a lot of effort the reason for the population decline remains unsolved.

A collaborative study with Lilach Hadany involves modeling the evolution of flower preferences by solitary bees and testing these models using data on "real" flower preferences of about 10,000 bees from nearly 200 species.

Steve is also using comparative genomics to study insect-induced plant galls (abnormal growth structures) to determine which portions of the plant genome are taken over and controlled by the insect to produce the gall. This work is a collaboration with **Joe Miller**, manager and supervisor of the instrumentation laboratory associated with the Roy J. Carver Center for Comparative Genomics. These studies could yield valuable insight into potential mechanisms by which plant growth may be manipulated for human purposes.

One arm of **Ming-Che Shih's** research program also uses comparative genomics tools to understand the evolution of the regulatory networks that control the response of plants to stress. The laboratory uses the model plant, *Arabidopsis*, closely related to wild mustard. The advantages of this experimental system are that the entire genome has been sequenced and analyzed in tremendous detail. Most plant species have evolved elaborate mechanisms to sense environmental conditions and adjust their growth and development accordingly. A substantial number of genes are involved in these stress responses and the Shih laboratory is using a global approach to find all the genes that respond to different types of stress. Current thinking is that stresses, such as hypoxia, dehydration, and salt, induce the expression of genes that are specific to the particular stress in addition to a common set of genes. A description of how stress responsive genes are regulated under different environmental conditions will make a substantial contribution toward understanding how stress responses have evolved and be of inestimable value to cultivation of a wide variety of commercial plants.

OBITUARIES

(Birth names in parentheses)

Beck, Virgil B., B.A. (Zool) '42.

Bovee, Eugene C., Ph.D.; M.S. (Zool) '48.

Bullock, Hazel G. (Goodale), M.S. (Zool) '37.

Feldman, Jonathan M., M.D.; B.A. (Zool) '77.

Goodale (see Bullock).

James, Pauline, M.S. (Zool) '55.

Kier (See Townsend).

Kollros, Jerry J. (see article).

Martin, Hugh W., M.D.; B.A. (Zool) '42.

Matarese, Barbara F., M.S. (Zool) '58.

Miller, Daniel W., M.D.; B.S. (Biol) '93.

Ohlsen, John E., M.S. (Zool) '50.

Phillips, Robert F., M.S. (Zool) '50.

Plueddemann, Carol E., M.S. (Botany) '69.

Reynolds, Joshua J., B.A. (Biol) '95.

Swanson, Donna Y. (Yeck), B.A. (Zool) '48.

Townsend, Mildred (Kier), B.A. '31.

Trainer, Max T., B.A. (Zool) '37.

Yeck (see Swanson).

ALUMNI NEWS

(Birthname in parentheses)

Cotton, Paul, M.D., B.S. (Biol.) '86 BS/MD University of South Dakota School of Medicine 1989/1991, Internship Medicine UC Irvine 1992, Residency Anesthesiology USC, 1995 Anesthesiologist at Sharp Coronado Hospital. Volunteered for the past 10 years providing free anesthesia services to underprivileged children in Cabo San Lucas, BCS, Mexico, with Amigos de los Ninos.

Kvaal, Christopher, Ph.D. (Biol.) '99 is Associate Professor of Biological Sciences at St. Cloud State University, St. Cloud, MN 56301. Friends can email him at cakvaal@stcloudstate.edu.

Palmer, Robert, M.D., B.S. (Biol.) '98 received his M.D. degree from the Chicago Medical School in 2004 and currently is a resident in diagnostic radiology at the U. of Miami Jackson Memorial Hospital, Miami, FL.

Smith, Paul, Ph.D. (Zool.) '62 From Bovbjerg and the Bogs of Iowa to the marshes of San Francisco Bay Delta in fresh water again after 40 years of studying schooling pelagic fishes off the temperate coasts off all continents. Retired and serving on the Independent Science Board of the California Federal Science Projects in the Sacramento/San Joaquin Delta focusing on the endangered endemic Delta Smelt. Adjunct Professor at UC, San Diego Scripps Institution of Oceanography.

ALUMNI FELLOW

Carol Dahl, a 1977 UI Biology alumni, has been selected as one of six Alumni Fellows chosen this year by the College of Liberal Arts and Sciences. The Fellows program recognized CLAS graduates for outstanding contributions to society, their professions, the college and the UI.

Currently, Dr. Dahl directs the Bill & Melinda Gates Foundation's Global Health Technologies Initiative. This initiative makes grants to achieve fundamental scientific advances in global health. Prior to joining the foundation, Dahl also served as Vice President for strategic partnerships at Biospect.

From 1990 to 2001, Carol Dahl worked in several capacities at the National Institutes of Health. She served as assistant to the director of NCI, advising on technology development opportunities in support of the National Cancer Program, and as program director for the Sequencing Technology Branch at the National Center for Human Genome Research. In 1998, she guided the creation of the Office of Technology and Industrial Relations at the National Cancer Institute (NCI) and served as its first director through 2001. As Director, she implemented cross-cutting and experimental technology development programs including the "Innovative Technologies for the Molecular Analysis of Cancer Program", managed the "Unconventional Innovations Program", and facilitated the relations of industry with the extramural programs of the NCI.

While at the NCI, Dr. Dahl supported the development of the biotechnology portfolio of the Advanced Technology Program of the National Institutes of Standards and Technology. She also held the position of Guest Researcher at the Advanced Technology Program (ATP) in the National Institutes of Standards and Technology in the Department of Commerce and was previously Program Director of the Sequencing Technology Branch at the National Center for Human Genome Research (NCHGR).

Carol Dahl received her bachelor's degree with honors from the University of Iowa in 1977, conducting honors research in Michael Solursh's lab. She received her PhD from the University of Wisconsin-Madison in 1982 under the direction of Robert Auerbach. She received postdoctoral training at the Karolinska Institute in Stockholm, the Pasteur Institute in Paris, and the Immunobiology Research Center at the University of Minnesota. Subsequent to her postdoctoral research training, Dr. Dahl joined the faculty of the Pittsburgh Cancer Institute.



Carol Dahl

FACULTY SPEAKER INVITATIONS

M.E. Dailey gave research talks at the 8th International Neuroscience Winter Conference, Solden, Austria, and at the meeting, Scanning 2007: 18th International meeting of the Foundation for Advances in Medicine and Science, Monterey, CA. He was the keynote speaker for the Fetal Alcohol Spectrum Disorders Study Group, Baltimore MD.

D.F. Eberl presented three invited talks on the mechanisms of hearing in *Drosophila*: Dept. of Otolaryngology, U. of Michigan, Dept. of Pediatrics, U. of Utah and the Dept. of Cell Biology and Anatomy, N.Y. Medical College, Valhalla, NY. He also talked on Myosin VIIA function in hearing at the Dept. of Biological Sciences, U. of Alberta, Edmonton, Canada. He also was a Session Chair at the 20th Annual Biologic Basis of Pediatric Practice Symposium, Congenital Hearing Loss, Deer Valley, UT.

J. Frankel spoke in Gif-sur-Yvette, France in the "Symposium in Honor of Janine Beisson". Dr. Frankel also was co-organizer and a presenter at the Annual Conference of the Mid-west Protozoologists, Iowa City.

S.H. Green gave invited talks at the 2nd Williams Conference on Tissue Engineering of the Inner Ear ("Spiral ganglion neuron survival and regeneration in vitro"), Vienna, Austria, and the 7th International Academic Conference of Immunobiology in Otorhinolaryngology: Bionics and Regeneration of the Ear ("Connecting the auditory nerve to its targets in vitro."), Melbourne, Australia. At the latter conference, he also chaired the Plenary Session on "Protection of the ear in surgery, cochlear implantation and medical disease-II."

G. Gussin presented a talk at the meeting on Phage Genetic Networks, Copenhagen, Denmark.

L. Hadany gave the lecture, "Why obligatory sex?" in the Dept. of Evolution, Systematics and Ecology, The Hebrew U., Israel. She also spoke to the Dept. of Evolution and Ecology, Indiana U., Bloomington, "The informative value of stress: Implications for the evolution of sex and death," and as an invited speaker at the Alternative Perspectives on Evolutionary Dynamics Symposium, Evolution 2006, Stony Brook, NY.

S.D. Hendrix was a symposium speaker at the 13th Annual Wildlife Conference, and spoke to the Society for the Study of Evolution, and to the Iowa Dept. of Transportation Living Roadway Trust Fund Annual Meeting.

D.W. Houston spoke on, "Novel roles for maternal Zic2 and Tgif in the control of nodal signaling in *Xenopus*", at the Dept. of Genetics, Case Western Reserve U., Cleveland, OH.

A.R. Kay delivered a talk, "Zinc signals 6", in the Carlo Besta National Neurological Institute, Siena, Italy.

J.M. Logsdon gave invited talks at two Gordon Conferences, New London, CT, the G.C. on Meiosis (Natural history of meiotic genes and secret sex lives of eukaryotes), and the G.C. on Molecular Evolution ("Molecular Voyeurism: Using a meiosis detection kit to reveal hidden sex lives of eukaryotes (this same talk was given as a seminar to the Morehouse School of Medicine, Atlanta, GA). Additionally, he spoke at the Phylogenomics Symposium of the Soc. for Molecular Biology and Evolution Annual Meeting, Tempe, AZ., and the Midwest Protozoologists 38th Annual Conference, Iowa City, IA ("Insights into the evolution of meiosis from conserved genes: sex genes in protists and other eukaryotes").

B.F. McAllister gave the following invited talks in 2006: "Early events in the evolution of sex chromosomes, Iowa State U., Ames; "Evolution of sex chromosomes—'Juiced' and ready for selection" to the Dept. of Biology, Penn. State U.; "Effects of chromosomal rearrangements on patterns of recombination", Gordon Research Conference on Meiosis, Colby-Sawyer College; and a talk to the *Drosophila* Species Workshop, Tucson Stock Center, U. of Arizona, Tucson. He also gave a paper, "Nucleotide sequence diversity in newly Y-linked region of the *Drosophila americana* genome" at Evolution 2006, SUNY, Stony Brook, NY.

J.R. Menninger spoke on "Big loser codon pairs in *E. coli* have normal usage in other genomes", to the Amer. Soc. of Biochemistry and Molecular Biology annual meeting, Washington, DC.

M.-C. Shih gave a series of invited talks in the far east over 2006. He spoke at The Botany Institute, Chinese Academy of Science at Guanxi, Quilin, China; the International Symposium on Biomass conversion, the International Symposium on Evolutionary Genomics and the Institute of Plant and Microbiology, all at the Academia Sinica, Taipei, Taiwan; The Dept. of Environmental Engineering and College of Life Sciences, Da-Yeh U.

D.C. Slusarski was a speaker at the 3rd International Symposium, U. of Ulm, Germany, "Signals and

signal processing during cellular differentiation." She also participated in the Strategic Conference of Zebrafish Investigators.

D.R. Soll was the keynote speaker at a meeting of the British Soc. of Medical Mycology, Dublin, Ireland, and chaired the session on Cellular Morphogenesis at a meeting of the International Soc. of Human and Animal Mycology, Paris, France, and chaired the session on Cell Morphogenesis at the ASM Candida Meeting, Denver, CO.

B.A. Stay presented talks at the International Union for the Study of Social Insects, Washington, DC; At the Entomological Soc. of America, Indianapolis, IN and at the Insect Molecular Science meeting, Tucson, AZ.

C.-F. Wu gave two international talks, to the Fourth Congress of the Federation of Asian-Oceanic Neuroscience Societies, Hong Kong, and to the Fourth International Neuroscience Symposium in China, Kunming, China. He also spoke at the Institute of Neuroscience, Chinese Academy of Sciences, Shanghai, China, to the Institute of Molecular Biology, Academia Sinica, Taipei, Taiwan, and to the College of Science, National Central University, Taoyuan, Taiwan.

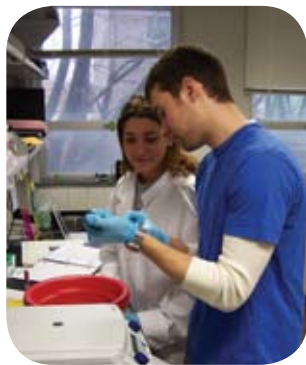
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