

## THE FUTURE OF BIOLOGY EDUCATION

By Lori Adams-Phillips

It is an exciting time to be an educator in the Life Sciences as we are currently in the midst of a national revolution in the way we teach biology. A decade's worth of reports by distinguished agencies and journals have called for rethinking and restructuring of high school and undergraduate science education. A major goal of this reform is to train our future scientists with the knowledge and skills they will need to be successful in the 21st century using promising teaching practices based on research on human learning and cognition. Additionally, it is recognized that science needs to be made more relevant and accessible to a broader spectrum

of students, to increase scientific literacy in our society as a whole.

A number of recent events and publications offer

a collective vision for how to nationally improve science education. *The Scientific Foundations for Future Physicians*, published in June 2009 by the American Association of Medical Colleges and Howard Hughes Medical Institute, calls for a change in undergraduate science education to move towards a system based on "competencies" deemed important for medical school education. The competencies defined by the AAMC and HHMI and the action items set forth by the report "Vision and Change in Undergraduate Biology Education" summit held by the American Association for the Advancement of Science with support from the National Science Foundation set the tone for the development of specific learning goals and outcomes that maintain scientific rigor and reflect the nature of scientific discovery. Recommendations made in *A New Biology for the Twenty-First Century* recently published by a committee under the National Research Council's Board on Life Sciences, offer insight into future interdisciplinary curricula that will be necessary for educating the "New Biologist". While the fundamental

principles of the biological sciences remain unchanged, breakthrough discoveries and new and emerging technologies are changing the ways key questions are addressed as biologists increasingly find themselves asking questions relevant to the fields of Chemistry, Math, and Physics. The "New Biologist" commands a deep knowledge in one discipline and a "working fluency" in several others.

These latest recommendations are the focus as we develop new initiatives in the Department of Biology to prepare our students for careers as biology researchers, health care professionals, as well as future science educators. With the backing of the Provost, Biology is developing a new paradigm of teaching that will stimulate

**"As a research department in an academic institution the teaching of future scientists is, and has always been one of our priorities"**

interest in biology, increase the number of students that complete a course, involve students much earlier in research, and

provide an integrated approach to teaching in the sciences. In line with this initiative, an application for two of our faculty to attend the National Academy's Summer Institute for Undergraduate Biology Education has been officially accepted. The goal of the Summer Institute is to transform biology education at research universities by improving classroom education and attracting more diverse students to research.

As a research department in an academic institution, the teaching of future scientists is, and has always been, one of our priorities. With new ideas, enthusiastic teachers, and new programs, we will be able to serve the present and future needs of our students while providing the researchers of tomorrow the training and expertise they need to succeed.







# 2009 IN REVIEW

January 2009 through December 2009 marked my first full year as DEO of the Department. And what a year it has been. It started with several retirements (Drs. Wei-Yeh “Andy” Wang, Jeffrey Schabillon, Gary Gussin, and Ming-Che Shih),

hiring of a new faculty (Dr. Ana Llopart) and submission of the P30 grant application for over \$2 million. The next two months were occupied with a search for two new faculty members with a total of seven interviews in five weeks. The high pace we had to go through was tough on everyone but we successfully completed our search and have now two new additions to our faculty, Drs. Sarit Smolikov and Bryan Phillips. Together these two new faculty members are establishing a new model organism, the worm *C. elegans*. The second half of the spring semester was occupied with reorganization of the Graduate Program to shorten the time to degree and the reorganization of the Roy J. Carver Center for Genomics (CCG) to open this core up to the entire Department. During summer and early fall the Department has submitted several major grants totaling more than \$8 million in support. These included a resubmission of the P30 (now funded), an

NSF IGERT (soon to be resubmitted), and an HHMI training application (that missed funding by a narrow margin). Later in the fall we moved forward with one faculty search and have now hired two additional researchers, Drs. Bridget Lear and Andrew Forbes. Both will be starting in the fall of 2010. The fall proved to be extremely busy with four faculty members being reviewed for tenure or promotion, two for tenure and two for promotion to full professor. Dr. Stephen Hendrix and his team did a remarkable job getting all this done on time, and the recommendations of the Department were approved. It is with great pleasure that I welcome two new Associate Professors, Drs. D. Houston and C. Stipp and two new Full Professors, Drs. D. Eberl and D. Slusarski. In addition, the fall of 2009 saw more faculty moving toward retirement (Drs. Jonathan Poulton and Diana Horton) reducing in the next few years the total faculty even further. Due to the reduced monetary support the University received, we all experienced a widening gap between increasing teaching load and increased student enrollment aggravated by the smaller number of faculty. It is with great anticipation that I am looking forward to the coordinated growth of the Department once the fiscal crisis of the State of Iowa is replaced by a healthy growth rate.

On a personal note, my laboratory has seen an enormous growth and has reached full capacity through the acceptance of three graduate students, one MD/PhD student, and the hiring of two postdoctoral researchers. Thanks to our

laboratory research assistant, our mouse colony in our new quarters is extremely successful in delivering the necessary mutant mice to speed up publications. Currently we have over 10 papers in various stages of completion indicating that the research in the laboratory is taking off.

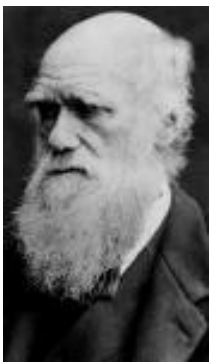
My own R01 funded research received additional funding through a NIH competitive revision application of \$358,000 for the next two years. For this competitive revision we propose to make use of the 454 deep sequencing capabilities to establish the molecular basis of mechanosensation needed for hearing with a novel scheme. If this endeavor is successful, we will have the molecular basis for mechanosensation in hand allowing us to regulate the genes associated with hearing loss, and to ultimately restore hearing in humans who suffer from it. In addition, a grant application in which I was Co-I was funded for five years. This grant is aimed at an in-depth analysis of the function of microRNA in the ear.

The department and faculty continue to evolve to successfully meet the challenges and opportunities of an ever-changing environment. As chair, I continue to endeavor to balance my research and leadership and continue to build the biology department of the future.

Bernd Fritzsich, Ph.D.  
Professor and Chair

## NOTEWORTHY MEETINGS

### Society for Molecular Biology and Evolution



The 2009 annual meeting of the Society for Molecular Biology and Evolution was held in Iowa City, June 3-7, 2009. The meeting was organized by John Logsdon along with faculty, staff, and students from the department. The theme, Darwin to the Next Generation, honored Charles Darwin's

200th birthday and the 150th publication anniversary of *On the Origin of the Species* and also recognized both the human creativity and technological innovations that are revolutionizing our understanding of the

evolution of genes, genomes, and organisms. The meeting featured more than 20 topical symposia highlighting the latest findings in traditionally important and newly-emerging research areas. The Nei Lecture, *Mutation and Evolution*, was given by Michael Lynch, Department of Biology, Indiana University. The meeting was attended by nearly 700 people from across the globe.

### Society for Developmental Biology

Iowa City also hosted the 48th Annual Midwest meeting of the Society for Developmental Biology (SDB). The SDB is dedicated to advancement of the field of developmental biology and to advance our understanding of developmental biology at all levels. Co-organized by Diane Slusarski and Doug Houston, the meeting featured



talks by students, postdoctoral fellows, and junior faculty. The education session *Four-dimensional Thinking in Developmental Biology* was

presented by Jeff Hardin, University of Wisconsin. The meeting began with a keynote lecture about Building the Vertebrate Brain, given by Hazel Sive, MIT/Whitehead Institute and ended with a keynote lecture about Posterior Body Formation during Embryogenesis given by David Kimelman, The University of Washington.

# NEW FACULTY

## Ana Llopart

In our laboratory we seek to understand the evolution of the genetic barriers responsible for species being reproductively isolated from one another. Today we know that these barriers often involve genetic incompatibilities among alleles that function normally in their usual genetic background and produce perfectly fit genotypes, but generate hybrid dysfunction (i.e. sterility and inviability) when they encounter alleles from other species. To gain insight into the evolution of these genetic barriers, we study hybrids where incompatibilities become apparent. Our approaches use methodologies that combine classic genetics, modern genomics, and population genetics, and an ideal biological system of two very closely related species of fruit flies, *Drosophila yakuba* and *D. santomea*. The former species is widely distributed in sub-Saharan Africa and in the islands near the continent while the latter is endemic to the small volcanic island of São Tomé. Like several other related species, these species can be crossed in the laboratory and produce hybrid females that are fertile, which facilitates the genetic analysis of reproductive isolating barriers taking full advantage of the plethora of genetic tools available in *Drosophila*. What is truly unique about the system is the high frequency of hybrids found in the wild. Although the two species are thought to have evolved in geographic isolation, the mainland species *D. yakuba* has invaded secondarily the island where today both species form a classical hybrid zone. The genetic analysis of hybrid zones provides the unique opportunity to identify genes involved in hybrid dysfunction under natural conditions. The combination of both laboratory experiments and natural introgression will shed some light on the evolution of genes and their genomes, that define species.

## Bryan Phillips

How does a fertilized egg become an adult animal? Finding the answer is the focus of the Phillips Lab. Cell-to-cell communication is a common way cells are instructed to proceed down one particular developmental path versus another. Mutations in genes controlling cell communication result in cells adopting an inappropriate cell fate. In humans, these mutations can lead to disease or death. We use the nematode, *Caenorhabditis elegans* to address the problem of how cell differentiation works in multicellular animals. *C. elegans* has many attributes that make it well-suited to study developmental biology. *C. elegans* also uses cell signaling pathways to control cell fate decisions during development.

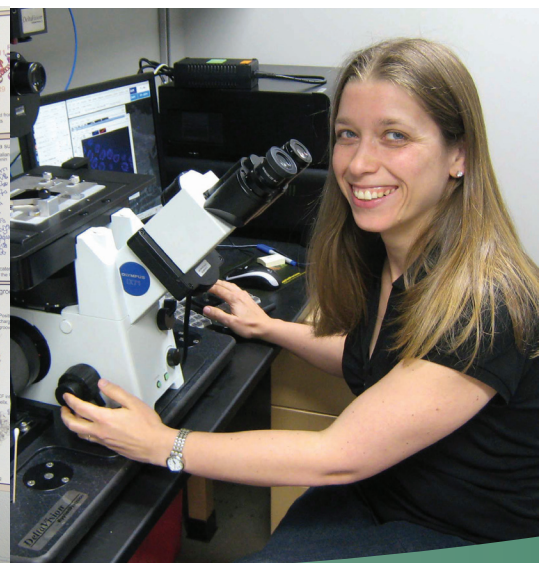
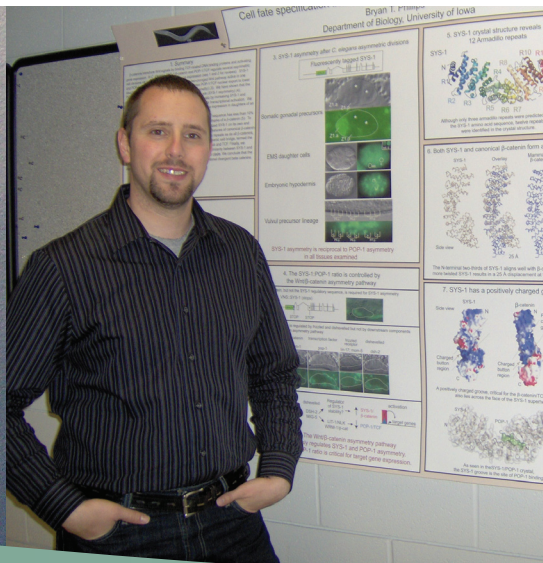
The Wnt signaling pathway regulates cell fate in many animals, including mammals. Wnt signaling stabilizes a transcriptional coactivator called  $\beta$ -catenin, which then binds to DNA-binding proteins and converts them into activators of Wnt target gene expression.  $\beta$ -Catenin regulation is a crucial step in the Wnt signaling pathway in all animals.  $\beta$ -Catenin mis-regulation is associated with a wide array of developmental defects and human diseases such as cancer. *C. elegans* utilizes the Wnt signaling pathway to instruct cells to become endoderm (intestine) instead of mesoderm (muscle). An essential component of this pathway in *C. elegans* is SYS-1, a  $\beta$ -catenin responsible for upregulating Wnt target genes much as other  $\beta$ -catenins do in other organisms. We study the function of SYS-1 to dissect how  $\beta$ -catenins work. Other areas of interest in the Phillips lab are determining how other aspects of the Wnt pathway function in *C. elegans*,  $\beta$ -catenin regulation, and  $\beta$ -catenin evolution. These studies will help us understand the larger question of why animal cells differentiate the way they do.

## Sarit Smolikov

The vast majority of multi-cellular organisms reproduce sexually, a process involving the joining of a sperm and an egg to form an embryo. In order to allow normal development of an embryo, each sperm and egg must contain half the parental genome. Any alterations in chromosome numbers will lead to formation of an embryo that cannot function properly, resulting in embryonic lethality. Alteration in chromosome number is the leading known cause of miscarriages and birth defects in humans. Any progress in our understanding of these defects depends on understanding the mechanisms leading to accurate reduction of chromosome numbers during sexual reproduction.

Halving chromosome numbers in the process of creating an egg or a sperm is achieved through a special cell division called meiosis. In preparation for the meiotic division, various events must be coordinated to ensure that chromosomes will be separated properly. This includes the identification of pairs of chromosomes targeted for separation, their association, and the formation of linkage between them, locking their identity as pairs.

In our lab we use genetic and cell biology tools to identify novel genes essential for meiotic chromosome segregation. We perform our studies in the well-established animal model system of *Caenorhabditis elegans*. We carry out genetic screens to isolate mutants exhibiting embryonic lethality and identify the precise meiotic defects in these mutants using high-resolution microscopic analysis. Based on the evolutionary conservation of meiosis, our studies will lead to a better understanding of chromosomal behavior in sexual reproduction in other organisms as well, including humans.





## CONGRATULATIONS GRADUATES OF BIOLOGY

Ph.D.s

Summer 2009

**Koehn, Demelza (Malone lab)**

"Analysis of Meiotic Recombination Initiation in *Saccharomyces cerevisiae*"

**Mena, Paulina (McAllister lab)**

"The Role of Chromosomal Rearrangements in Adaptation in *Drosophila americana*"

**Yi, Song (Soll lab)**

"A Unique Relationship between Switching, Mating and Biofilm Formation in the Human Pathogen *Candida albicans*"

Fall 2009

**Prasad, Tuhina (Weiner lab)**

"The Role of gamma-Protocadherins in Interneuron Survival and Circuit Formation in the Developing Spinal Cord"

Spring 2010

**Foreman, Kelley (Malone lab)**

"The Signal Between the Initiation of Recombination and the First Division of Meiosis in *Saccharomyces cerevisiae*"

**Sahni, Nidhi (Soll lab)**

"The White Cell Pheromone Response Pathway in *Candida albicans* Provides Insights into the Evolution of New Signal Transduction Pathways"

**Sheeley, Sara (McAllister lab)**

"Investigating Patterns of Parallel Genetic Change in Repeated Adaptation"

**Williford, Anya (Comeron lab)**

"Local Effects of Limited Recombination in *Drosophila*"

M.S.s

Spring 2009

**Mumford, Karian E. (Fassler lab)**

"Characterization of the Oxidative Stress Regulation of Skn7 in *Saccharomyces cerevisiae*"

**Tyra, Heather (Bhattacharya lab)**

"The Exaptation of Nitrate/Carbon Stress-induced smRNAs and Their Targets from Transposable Elements in the Unicellular Alga *Chlamydomonas reinhardtii*"

Spring 2010

**Jenkins, Christina (Neiman lab)**

"Resource Limitation in Sexual vs. Asexual *Potamopyrgus antipodarum*"

**Hass, John (Dailey lab)**

# FUNDING MATTERS

## The Future of Research Scientists

By Jane Van Voorbis

As you may have noticed, we have not published a donor honor roll in the current newsletter. It's not that we don't want to acknowledge the wonderful generosity of our many supporters. It is more that you all bring so many varied gifts to the department - gifts of time, expertise, and financial resources - that it is impossible to enumerate the many ways you support Biology. Our many friends and supporters are truly a valued resource.

I was pleased when Bernd Fritsch offered me the space in this newsletter and the opportunity to fill you in on fundraising priorities. During this time of diminishing resources, the University has come to depend more than ever on private sources of funding. The need for graduate student support is particularly acute. In answer to that need, Professor Fritsch has been directing much of the department's discretionary funds to provide financial aid to doctoral candidates. Graduate students are critically important not only to the successful functioning of a lab, but also to the research and teaching goals of the department. Your contributions support

**"Your contributions support not only individual students, but the scientific enterprise of The University of Iowa and, ultimately, the future scientists of the world."**

not only individual students, but the scientific enterprise of The University of Iowa and, ultimately, the future scientists of our world.

I am delighted to report that with the help of many alumni, we have taken some important steps toward securing permanent sources of funding for graduate students. In 2009, a former student of Jerry Kollros honored her former advisor and his commitment to graduate education by generously providing a leadership gift to establish the Jerry Kollros Graduate Student Fund. Following her lead, 44 other friends and alumni of the department have contributed to the fund, resulting in endowed assets totaling nearly \$70,000. The fund's current value only reflects outright gifts and pledges—we also have a deferred gift expectancy that will augment the endowment. Funds like the Kollros Graduate Student Fund allow us to connect our past to our future through your generosity of spirit.

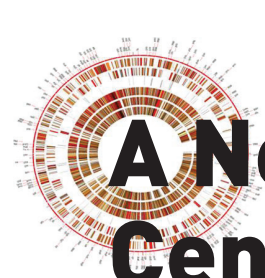
Your gifts allow the department to continue to recruit highly talented students and to keep their heads above water when they are with us. On behalf of the students and faculty who benefit from your many gifts, we thank you.



## Graduate Friends & Alumni Fellowship Fund

This fund was created to provide support for our graduate students, a critical component to our success. Salary and tuition costs exceed \$35,000 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.





# A New Era For The Roy J. Carver Center For Genomics (CCG)

When Harsha Doddapaneni agreed to accept the position as manager of the CCG, no one said it would be easy. Under the leadership of John Logsdon (2007-2009), the CCG (then the Carver Center for Comparative Genomics), was only serving faculty in the department. The Carver Center for Genomics (CCG) needed to undergo significant changes to meet the growing demands of researchers in the department as well as the institution. Approximately one year ago, the Carver Center for Comparative Genomics became the Roy J. Carver Center for Genomics (CCG) a departmental and institutional service center.

The CCG has continued to grow and has launched a new website, introduced a new pricing structure, and will be shortly launching a new and streamlined scheduling and billing database system.

In April 2010, CCG received funds from the GIVF initiative for the project entitled “Novel and Improved Sample Preparation Protocols for Next Generation Sequencing Technologies” from the Iowa Centers for Enterprise. This seed fund program is supported by Iowa Department of Economic Development appropriations to the Iowa Board of Regents under the Grow Iowa Values Fund (GIVF).

The CCG also started a new “Technology” seminar series. The objective of these seminars is to provide the most up-to-date information on the existing CCG technologies and also to introduce new technologies to the user groups.

Valerie Reeb, Ph.D. joined CCG as a postdoctoral research scholar in September 2009 (previously with Bhattacharya lab) and is focusing on 454 pyrosequencing and NimbleGen microarrays. The CCR has two talented student

employees: Jeffrey Carlton (undergrad) working on the ABI sequencing and Drew VanDaele (Master’s student) working on MS Access data base design for the new billing system.

**Harsha Doddapaneni, Ph.D., Research Scientist**, joined the department in 2008 from a postdoctoral fellowship in the Department of Viticulture and Enology at University of California, Davis and was stationed at the USDA, SJV-ARS center in Parlier, California. Harsha has received funding from the USDA.

**Research focus for the CCG:** Comparative genomics of bacterial and fungal P450s and the development of genomics protocols and bioinformatics tools for next-generation sequencing, microarrays and large scale data mining.

## ACCOLADES

*Douglas Houston, Ph.D.* – Promoted to Associate Professor

*Chris Stipp, Ph.D.* – Promoted to Associate Professor

*Daniel Eberl, Ph.D.* – Promoted to Full Professor

*Diane Slusarski, Ph.D.* – Promoted to Full Professor

*Diane Slusarski, Ph.D.* – Collegiate Teaching Award (2010)

*Michael Dailey, Ph.D.* – Collegiate Teaching Award (2009)

*Daniel Eberl, Ph.D.* – Career Development Award (2008)

*Stephen Hendrix, Ph.D., Chun-Fang Wu, and John Logsdon* - Career Development Award (2009)

*Bryant McAllister, Ph.D.* – Dean’s Scholar (2008-2010)

*David Soll, Ph.D.* – Lucille K. Georg Medal from the International Society of Human and Animal Mycology (2009)

*Bernd Fritsch, Ph.D.* – Named AAAS Fellow (2009)

*Phil Ecklund* – Outstanding Staff Award (2008)

*Jonathan Poulton, Ph.D.* - first winner of the Student and Staff Award for Outstanding Honors Advising established by The Honors Steering Committee.

*Twenty-four Biology faculty and staff* were among those recognized by graduating seniors as faculty and staff who had the most positive effect on their lives while they were at The University of Iowa. **Jonathan Poulton, Ph.D.**, received special recognition for ranking among the top 25 university-wide by being named by 10 or more seniors.

## Years in Biology

Srikantha Thyagarajan, Soll Lab – 20 Years  
Paula Bergstrom, Assistant in Instruction – 10 Years  
Gery Hehman, CCG – 10 Years  
Nicole Kohler, Soll Lab – 10 Years  
Trudi Westfall, Slusarski Lab – 10 Years





# Understanding the Genetics of Disease and Birth Defects - A Step Closer

The Manak Lab focuses heavily on identifying the genes involved in a number of birth defects and diseases, including spina bifida and epilepsy, cleft lip and palate, renal agenesis (where kidneys fail to develop), schizophrenia and autism, and rheumatoid arthritis. Several laboratories here at Iowa and on the east coast have partnered

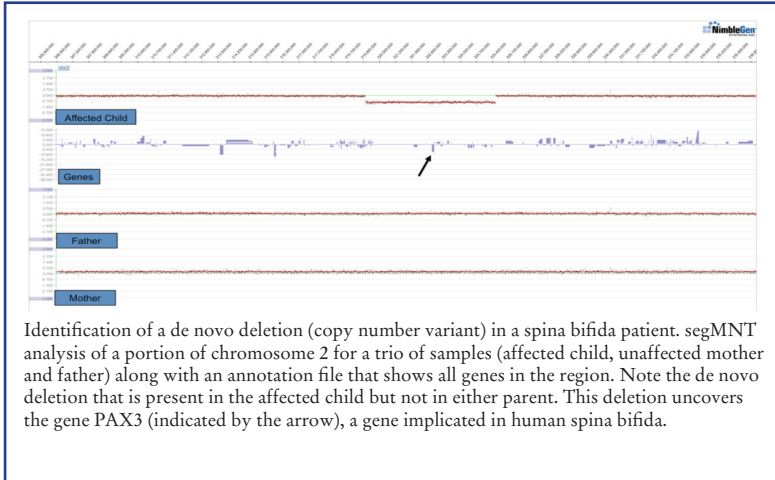
with us to provide the required genomic DNA samples. The lab uses a cutting-edge genomics technique (called array-based comparative genomic hybridization) to identify both deletions as well as amplifications that cause these diseases. These deletions/amplifications are called copy number variants (CNVs). Once

such genomic rearrangements are identified, one can look within them to see which genes are altered, thus identifying genes that are involved in the disease process. The methodology greatly expedites identification of disease-associated genes compared to earlier methodologies that took much more time, effort, and money. Putative disease-associated

genes for spina bifida and renal agenesis have been identified, and analyzing the data for the other diseases is currently under way. Dr. Manak was recently awarded a \$4.8 million grant from NIH that will focus on identifying the genes associated with the birth defect, cleft lip and palate. Co-investigator Dr. Jeff Murray in the Department of Pediatrics at the Carver College of Medicine\* is a well-established researcher in the clefting field. Using these new genomic techniques, the candidate genes will be identified. Once candidate genes are identified, functional studies will be performed using zebrafish in the laboratory of Dr. Rob Cornell (Carver College of Medicine) another co-investigator on the grant.

A group has been formed called CNVIowa consisting of seven principal investigators that specialize in CNV research. This group strives to be a world leader in CNV research. Watch for a new website that should launch within the next few months for this exciting and important research area.

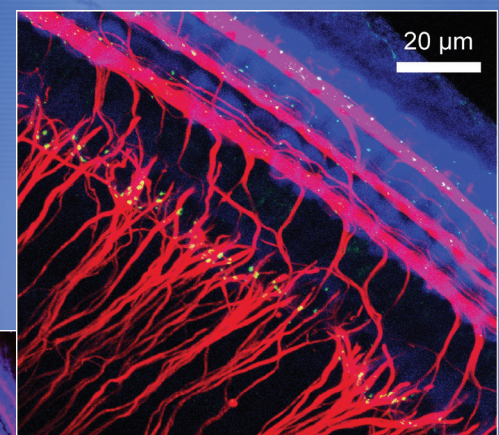
\* Dr. Murray has a secondary appointment in Biology.



## CAN YOU HEAR ME NOW?

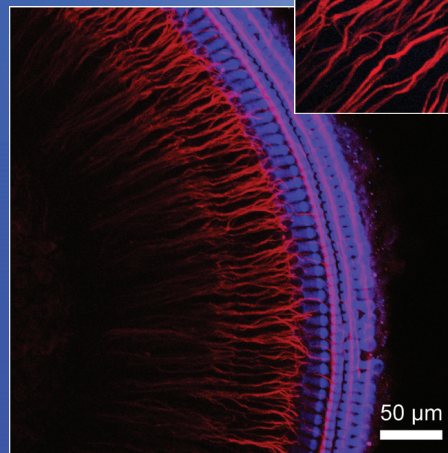
Research by Steven Green's Lab has mainly focused on what happens to auditory neurons in the cochlea when they receive too little input and are inactive, i.e., what happens in deaf individuals. A paper recently submitted to the *Journal of Neuroscience* is a departure. Dr. Qiong Wang, a postdoctoral fellow in the lab, has asked what happens to cochlear auditory neurons ("spiral ganglion neurons") when they receive too much excitatory input and are overly active, a phenomenon that neuroscientists term "excitotoxicity," which is a consequence of loud noise. Excitotoxic damage to the spiral ganglion neurons results in the loss of many connections – synapses – with auditory sensory cells. Dr. Wang developed methods to culture the cochlea maintaining sensory cells, neurons, and their synapses intact. Using this system, she has been able to investigate excitotoxic damage to the sensory cell to neuron synapses. Dr. Wang has shown that this in vitro model mimics what happens in vivo in animals exposed to loud

noise. The study has documented some synapse regeneration after the damage and identified a factor produced by the sensory cells necessary for synapse formation. Because of the relative accessibility of an in vitro system, further investigation of the causes of noise damage to spiral ganglion neurons and possible means to repair the damage can be explored. This is a long-term goal. In the meantime, make sure you turn down the volume of your iPod and make use of the volume limit setting!



The two images are a lower and a higher magnification view.

Above: Shows a cochlea with the auditory sensory cells (hair cells), cochlear neurons (spiral ganglion neurons) and their synapses intact in tissue culture.

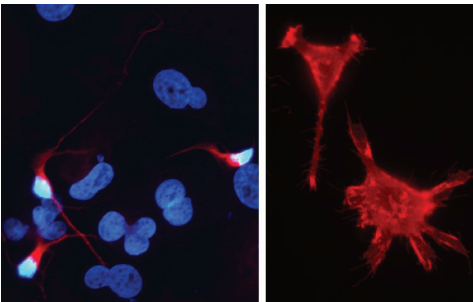


Left: The sensory (hair) cells are blue, the neurons and nerve fibers (axons) are red, and the synapses (visible only in the higher magnification) are the green dots.



## TEACHING YOUR CELLS TO WORK FOR YOU

The Stipp lab studies how cells interact with each other and with their surroundings. These external interactions are crucial factors in determining how cells respond in different situations. Specific topics of research in the lab include understanding why some tumor cells are more able than others to spread and cause metastases, and finding strategies to enhance the ability of nerve cells to regrow after injury. In both cases, the extent to which cells are able to migrate or move within the body is strongly influenced by the factors they encounter in their extracellular environment.



Above: The images show migrating tumors cells stained with red fluorescence and neuronal cells with red projections growing among non-neuronal cells whose DNA has been stained blue.

# Major Grants Take the Lead

Three major consortium grants were submitted in 2009 and 2010. These grants reflect the commitment of the department to research resources and education.

“The Iowa Center for Molecular Auditory Neuroscience” (Dr. Steven Green, PI) was awarded in May 2010 and will provide support for interactions between five UI departments including Otolaryngology, Biology, Biochemistry, Physiology, and Communication Sciences and Disorders. This support will bridge clinical and basic research. Funding would be provided by the National Institutes of Health under the P30 mechanism to provide Centers of Excellence. This grant will provide \$2.5 million for equipment, personnel, and salary support over five years. This is also the first time The University of Iowa has had a P30 with the College of Liberal Arts and Sciences (CLAS) and Carver College of Medicine faculty that was funded by NIH and headed by a principal investigator from CLAS.

A second grant targeted at improving the interdisciplinary interactions across several science departments within CLAS was submitted to the National Science Foundation (NSF) (Dr. Bryant McAllister, PI). The Integrative Graduate Education and Research Traineeship (IGERT) Program was developed to

catalyze a culture change in graduate education by establishing innovative new models for graduate education and training. This IGERT grant application asks for \$ 3.2 million over the next four years to support an integrated graduate program aimed at training several PhD students in evolution related topics. If funded, this would be the first time that the College of Liberal Arts and Sciences has received a NSF IGERT award.

The undergraduate training grant to HHMI was an application of support for four years with a total volume of \$2.2 million (Dr. Bernd Fritsch, PI). The grant aimed to expand previously HHMI funded undergraduate training to improve the laboratory work experience of a selected group of undergraduate students and expand mentor training of graduate and postdoctoral students. This grant was ranked highly but ultimately not funded as only 18 new grants (out of over 160 applications) were funded.

In addition to these major submissions, two R01 grants were awarded to Drs. Stipp and Wu in 2009 and one R01 to Dr. Manak in 2010. Dr. Comeron received one of the extremely competitive awards funded through the ARRA stimulus package, with a funding of less than 4%. Congratulations to all.

## EVOLUTIONARY GENETICS -The Key to Survival

Research in the lab of Josep Comeron focuses on understanding parameters influencing the efficacy of natural selection, with particular emphasis on recombination. His lab applies a multidisciplinary approach that combines the development of theoretical tools, computer simulations of the evolutionary process and large-scale genomic analyses.

Recombination has been long recognized as a mechanism that increases the efficacy of natural selection by promoting the clustering of rare but beneficial mutations on the same chromosome, while at the same time ensuring the effective elimination of deleterious mutations. This dual effect explains the dearth of populations without recombination (often with asexual reproduction) and the benefits associated with species with meiotic recombination that can continuously adapt to ever changing biotic or abiotic environments. The qualitative advantage of recombination, however, does not immediately explain why different species differ in their rate of recombination. Evolutionary biologists therefore have shifted from asking whether recombination is beneficial or not

to the more subtle question of how much recombination is optimal for a species and how variable is the recombination rate. The Comeron laboratory has been investigating the evolution and consequences of recombination since his postdoctoral tenure at the University of Chicago where he proposed a novel hypothesis on the benefits of intron presence adding a new twist to the debate on intron evolution. Along these lines, Dr. Comeron has recently been awarded a \$1.8M grant from the National Institute of Health (NIH) to study the evolution of recombination rates using next-generation sequencing techniques in collaboration with two other experts in evolutionary genetics and recombination, Prof. M. Noor (Duke University) and Assistant Professor C. Jones (University of North Carolina). This study will be the first in any eukaryotic system to assess variation in recombination rates within and between species, providing a unique glimpse into the evolutionary forces influencing the efficacy of natural selection.

A second line of research focuses on weakly selected mutations. Individually,

weakly selected mutations have much smaller selection coefficients than it is practical to demonstrate in the laboratory. Their total number across genomes however can reach tens of thousands with a potential combined effect that can impinge a significant difference in fitness. Comeron's Lab applies population genetics and molecular evolution techniques to detect selection on these naturally-occurring mutations. Previous analyses from the lab have shown significant selection, albeit very weak, on synonymous mutations (changes in the coding sequence of a gene that do not alter protein sequence) in different *Drosophila* species. Comeron also published an article in the prestigious Proceedings of the National Academy of Sciences USA (2006) demonstrating that synonymous mutations in humans are also subject to natural selection. This result is not only pertinent for evolutionary analyses but also in association studies of genetic diseases that too often neglect synonymous changes as potential causative mutations.



# ACHIEVEMENT AWARDS

## UNDERGRADUATE AWARDS

### 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 *2010 Robbie Prize* to **Gregory Bligard**.

### Clifford W. Hesseltine Scholarships

Two *Clifford W. Hesseltine Scholarships in Biology* are awarded annually to an outstanding senior Biology major who have done noteworthy research and/or are intending graduate work with micro-organisms. Each award is a prize of \$300.

The *2010 Clifford W. Hesseltine Scholarships in Biology* (\$300) were awarded to **Jeremy Sandgren (Slusarski Lab)** and **Maxwell Turner (Kay Lab)**, both Biology majors in their junior year, who have displayed excellence in both course-work and research.

### Richard G. Kessel Scholarship In Biology

The *Richard G. Kessel Scholarship in Biology* (\$750) is awarded to an outstanding senior Biology major who has performed noteworthy research and/or is intending to pursue graduate work in cell and/or developmental biology. The *2010 Richard G. Kessel Scholarship* is awarded to **Hannah Hoffman (Houston Lab)** for her work on nephroblastoma overexpressed gene (NOV) in *Xenopus laevis*.

### Evelyn Hart Watson Scholarship And Fellowship

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. The *Evelyn Hart Watson Summer Fellowship* awards \$750 to support continuing research in the laboratory. *2010 Evelyn Hart Watson Scholars:* **Samantha McCarthy (Moline High School)**

**Kelli Mohn (Kee High School)**  
**Joshua Viggers (Norwalk High School)**  
*2010 Evelyn Hart Watson Summer Fellow* **Alain Cagaanan (Green Lab)**

### Lowden Prize In Biology

The *Lowden Prize in Biology* (\$300) is awarded to an undergraduate student showing outstanding performance in the 2:134 Ecology course.

*2010 Lowden Prize in Biology:* **Samuel Bailin (Comeron Lab)**

### Iowa Center For Research By Undergraduates (ICRU)

*2010 Excellence in Undergraduate Research Award (Natural Sciences):* **Michael J. Molumby (Smolikov Lab)**

### Rhodes Dunlap Scholarship

*Rhodes Dunlap Collegiate Scholarship* (\$2,000) recognizes academic merit and/or community involvement.

**Joseph Nellis (Weiner Lab)**, was awarded a *Rhodes Dunlap Scholarship* as an exceptional sophomore Honors student. Joe is working with postdoctoral fellow Dr. Dietmar Schreiner, helping to develop new assays to identify novel protein-protein interactions engaged in by the neuronal adhesion molecules we study, the gamma-protocadherins.

### Other Undergraduate Award Winners



**Jeffrey Nirschl** was awarded a *Goldwater Scholarship* and a *Bill and John Fenton Scholarship*. The Barry M. Goldwater Scholarship and Excellence in Education Foundation, which was named in honor of the late U.S. senator, awarded the scholarship to 278 students nationally this year. The foundation seeks to encourage outstanding

students to pursue careers in mathematics, the natural sciences and engineering, and the scholarship is considered the premier undergraduate award of its type in these fields. **Thomas Harmon** - Adelaide Boerner Trickey Scholarship in Music or Psychology

### BIOLOGY HONORS GRADUATES

#### December 2009

Abby Matthews (Houston Lab)

Drew Waschkat (Houston Lab)

#### May 2010

Annika Anderson (Slusarski Lab)

Gregory Bligard (Dailey Lab)

Ashley Cobert (Eberl Lab)

Elwood Cook (Murray Lab)

Eric Darrah (Eberl Lab)

Trevin Hayman (Murray Lab)

Laura Henkle (Murray Lab)

Hannah Hoffman (Houston Lab)

Sophie Krajewski (Horton Lab)

Scott McDermott (Manak Lab)

Joshua Modrick (Slusarski Lab)

Amanda Nelson (Nieman Lab)

Lindsey Rhea (Murray Lab)

Christina Schiltz (Nieman Lab)

Amber Shimek (Soll Lab)

Wesley Smith (Eberl Lab)

Jordan Snetselaar (Dailey Lab)

Zachary Stecklein (Soll Lab)

Amira Yagi (Lin Lab)

## GRADUATE AWARDS

### Dean's Graduate Fellowship

The *Dean's Graduate Fellowship* program promotes recruitment of outstanding students who are underrepresented in their graduate discipline. It provides financial support that includes stipend, tuition, and a generous health insurance allowance. Graduate programs nominate their best applicants who are from underrepresented groups in their areas of study. Students may be pursuing doctoral or master's degrees (for master's degrees, preference is given to terminal master's degrees). Approximately



# GRADUATE RESEARCH

30 Dean's Graduate Fellows will matriculate annually to begin their graduate studies. Fellows receive continued support while they make good progress towards their degree—four years for doctoral students, two years for master's students.

Graduate student **Gabriela Hamerlinck** was awarded a *Dean's Graduate Fellowship* for 2009. Gabriela Hamerlinck is graduating from Augsburg College (Minneapolis, MN) with a double major in Biology and Mathematics. Her area of research interest is in Evolutionary Biology and in Ecology/Conservation. She has participated in summer research programs including (summer 2009) the Biodiversity and Environmental Policies in New Zealand and the Cook Islands through the Biology Department at Augsburg College, and in the Encouraging Linkages between Mathematics and Ecology (ELME) program at Michigan State University's Kellogg Biological Station. She is a McNair Scholarship recipient, and a member of the Augsburg College Tri-Beta Biology Honor Society.

## Other Awards

**Pam Pretorius (Slusarski Lab)** was awarded the *1st Place Student Oral Presentation* at the October 2009 University of Iowa Genetics Program Retreat for her talk "Vision Specific Function for the Newly Identified Bardet-Biedl Syndrome 3 (ARL6) Long Isoform."

**Angela Cordle (2010) (Lin Lab)** and **Sara Sheeley (2009)** were selected to receive the *Outstanding Teaching Assistant Award* from the University of Iowa Council on Teaching. The University of Iowa Council on Teaching's annual Outstanding Teaching Awards are awarded to teaching assistants who have demonstrated outstanding ability as teachers at The University of Iowa. Angela is a doctoral student with Chi-Lien Cheng and is scheduled to graduate in July 2010.

**Christina (CJ) Jenkins and Francesca Baglivi** gave presentations at the 2010 Midwest Ecology and Evolution meetings in Ames, Iowa.

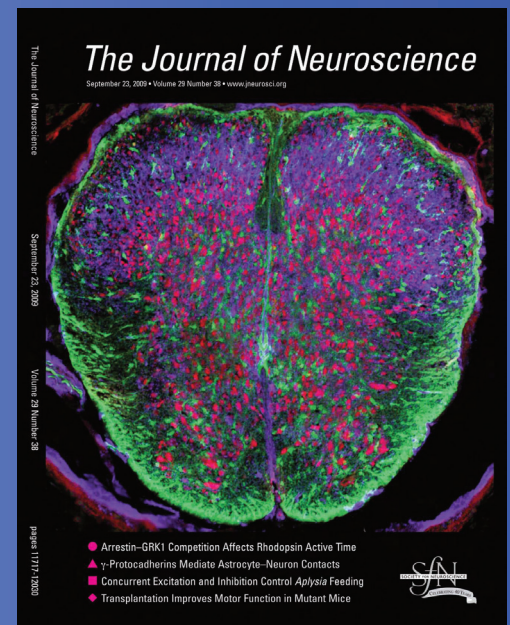
**Song Yi (Soll Lab)** was selected to give a platform presentation, Modern approaches to pathogenesis and infectious disease for the conference Genetics 2010.

**Weiner Lab:** Neuroscience program graduate student Andrew Garrett successfully defended his Ph.D. in November 2009 and published part of his thesis in an excellent paper in the *Journal of Neuroscience* in Sept. 2009. This article was featured on the cover and highlighted in "This Week in the Journal". Astrocytes are a type of glial or "support" cell in the brain. These astrocytes extend numerous fine processes that surround neuronal cell bodies, their tree branch-like dendrites, and their synapses, the points of connection they make with other neurons. It is known that astrocytes help ensure proper synaptic function, and recent work showed that, during nervous system development, they promote the formation of new synapses by releasing a kind of growth factor. However, the mechanism by which contacts between astrocytes and neurons drives the process of synapse formation has remained unknown. Work by Garrett and Weiner provides evidence that the gamma-protocadherins, a large family of sticky "adhesion" molecules, mediate these contacts between neurons and astrocytes. Gamma-protocadherins colocalized with markers of the astrocyte processes that surround synapses in the brain. In cultures of immature wild-type spinal cord neurons with astrocytes that lacked gamma-protocadherins, the number of synapses was greatly reduced compared to controls. Similarly, astrocyte-specific knockout of gamma-protocadherin genes in mice delayed the formation of many synapses, while ubiquitous knockout of these genes prevented their formation permanently.

**Chun-Fang Wu and Hongyu Ruan**  
**Research Finding:** Hanging out with younger individuals might help the elderly to live longer suggests a study on fruit flies with a gene mutation that reduces life span by interfering with an enzyme that mops up dangerous free radicals. Graduate Research Assistant Hongyu Ruan and Prof. Chun-Fang Wu investigated this surprising discovery to reveal the molecular mechanisms that govern the effects of social interactions on the aging process. The mutant flies that lived together with younger, healthier flies survived nearly twice as long and had

improved mobility and resistance to extreme heat and oxidative stress. Since this mutant gene disrupts the same enzyme implicated in human neurodegeneration diseases, such as Parkinson's, Huntington's, and Alzheimer's, the results suggest an effective health care for these patients not emphasized previously. Their finding has been cited by ABC and other news media in several languages.

**Slusarski Lab:** Although humans are symmetrical (even) on the outside with two arms, two legs etc, we are asymmetrical on the inside relative to the placement of our organs. Recent work from the Slusarski Lab has identified cues that lead to the appropriate placement of our internal organs. Graduate Student Igor Schneider characterized early signals in the zebrafish embryo that, when perturbed, result in random placement of the heart and other organs. These results have implications not only in understanding the normal progression of development but also in adult defects such as cardiovascular disease. This work was recently published in the journal *Development* and was funded by an American Heart Association pre-doctoral Fellowship to Igor Schneider and an NIH grant to Dr. Slusarski.



## ALUMNI KEEP IN TOUCH

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Fill out the ALUMNI PAGE of our website  
<http://www.biology.uiowa.edu>

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# CELEBRATING RETIREMENT



## Jeffrey Schabilion (2009)

joined the Department of Botany in 1968. Dr. Schabilion rose to the rank of Professor and left his mark on innumerable aspects of University and Iowa City life. Jeff was devoted to teaching at

both the graduate and undergraduate levels. Few College of Liberal Arts & Sciences faculty could brag that their research material was so weighty that it required a flatbed truck and a detachment of the Iowa National Guard to transport it across the state. But it is indeed true for Jeff. His area of research expertise lies in paleobotany. In the late 1970s, assisted by the Iowa National Guard, he brought a 16-ton fossil of a giant scale-tree [*Lepidodendron*] to UI from the Rus family farm in Pella. In 2005, Jeff's fossil scale tree—the largest ever collected—was donated to the Smithsonian's National Museum of Natural History, where it will go on public display.



## Wei-Yeh "Andy" Wang (2008)

joined the Department of Botany in 1975 and served as its Chair for three years. When the Departments of Botany and Biology merged, he served as Associate Chair of the newly

formed Department of Biological Sciences for five years. Dr. Wang's research focused on the biosynthesis of chlorophyll in the green alga *Chlamydomonas*. He taught such classes as Principles of Biology I, Plant Physiology, Topics in Plant Molecular Biology, and Fundamental Genetics. Dr. Wang retired at the end of the fall semester in 2008 after 33 years of service.



## Ming-Che Shih (2009)

After 21 years as a faculty member, Prof. Ming-Che Shih retired in December 2009. Prof. Shih conducted research on the response of plants to stress, trained numerous graduate

students and undergraduates, and was Director of the Carver Center for Comparative Genomics (2005-2007). Not quite ready to retire completely, Dr Shih accepted a position as Director of the then newly-established Agricultural Biotechnology Research Center (ABRC) of Academia Sinica in Taiwan where he will have the opportunity to influence national agricultural research policy in Taiwan.



## Jonathan Poulton (2010)

England's loss was Iowa's gain when 31 years ago Jonathan Poulton joined the faculty of the Botany Department. Many former students will remember

Professor Poulton as that excellent, enthusiastic teacher with impeccable diction who taught in such classes as Intro to Botany, Plant Biochemistry, and Principals of Biology I. For many years, Jonathan was also director of the Biology Honors Program and frequently taught the Honors Seminar. Poulton's research interests were in the area of plant biochemistry, especially cyanogenesis and carbohydrate metabolism.



## Gary Gussin (2009)

began his career at the University of Iowa in 1969 and has been in the Department of Biology exactly 40 years. His life-long research career was initiated during his PhD work with Dr. J.D.

Watson and concentrated on bacteriophages. Phages were the first organisms whose genetic information was decoded and thus served as the blueprint for the molecular revolution that so rapidly transforms our understanding of biology and medicine. Gary also served as chair from 1994 to 1999.



## Diana Horton (2010)

joined the Department of Botany in 1983. Hailing from Alberta, Canada, she appeared to embrace Iowa's winter weather as if it were positively balmy. Diana is recognized internationally as

an authority on bryophytes. Accordingly, Diana served as Director and Curator of the University of Iowa Herbarium for 20 years. She was Honors Director for the Botany Department and the Environmental Sciences Program. Deeply committed to teaching, Diana offered a wide range of courses, including Plant Diversity, and Ecological Plant Anatomy. As anyone who has accompanied her on a mid-February search for blooming skunk cabbage will confirm, one of Diana's greatest loves is to lead field trips to interesting habitats both near and far. We wish Diana and her canine companions all the best. Happy retirement!

# FUNDING AND GRADUATE TRAINING – BACK TO THE FUTURE

By Bernd Fritzsche

The University of Iowa recently completed the second graduate program evaluation in its history, with the first (that I am aware of) being conducted in 1969. Botany and Zoology, then two different departments, were ranked 'good' and 'strong', respectively. The rating of Biology in 2009 was also 'good'. In reflecting on these similarities in rating, I asked myself, "Has nothing changed in the last 40 years?" Being fairly new in the Department, I started digging through the various archives and found, to my surprise, that the historical role of the graduate program in Biology, as a whole, has been pivotal for the University of Iowa graduate program.

Biology was one of the earliest departments to obtain NIH grants to fund their graduate program. The first NIH-funded training grant in biology was called simply "USPHS Developmental Biology Training," directed by Richard Kessel, and was funded from 1966-1978. While Kessel's training grant was apparently the first of its kind in the Department of Biology, another major graduate training grant was launched in 1966 by the then chair in the

formerly named Department of Zoology, Jerry Kollros, in collaboration with Dr. Stephen Fox in the Department of Psychology (who became the first director of the program). A narrative excerpted from Dr. Kollros' CV asserts "I was co-director of the grant at the time of the initial [application]. It might be well to record that many persons in the medical school were dragged into the program with some reluctance, for reasons we could not understand. They have since profited." After the initial three years, this grant was administered by Dr. Suh (Pharmacology, 1969-1972) followed by Dr. Hegmann (Biology, 1972-1977). Dr. Hegmann then submitted a new grant "Training in Neural and Behavioral Sciences" in 1977. Due to health issues, Dr. Hegmann retired, and the grant was transferred to Dr. Harvey (Psychology) in 1981 and was transferred again to Anatomy & Cell Biology in 1991 and ended in 1998. Building on this foundation, the Iowa Neuroscience Graduate Program was established in 1984 to formalize the long-standing, interdisciplinary commitment of a diverse faculty. Since 1998, this program has continued as the extremely

successful Interdisciplinary Graduate Program in Neuroscience that now, as much as then, depends critically on the teaching and training opportunities provided by Biology faculty.

I discovered with great pleasure that the Neuroscience Graduate Program ranked in the highest (exemplary) category according to the recent Graduate Program Task Force Report, as this high ranking reflects, in no small measure, the continued input of Biology faculty. The T32 Neuroscience Graduate Training Grant has been renewed recently. As the program director, Dr. Daniel Tranel, indicated, the contribution of the Biology faculty in teaching, among other efforts, was pivotal for the success of this competitive renewal.

The Molecular and Cellular Biology Program which ranked in the second highest (high quality) category in the recent Task Force's review of graduate programs was also launched by a T32 grant that started in Biology. The Interdisciplinary Graduate Program in Molecular and Cellular Biology was one of the first inter-departmental graduate programs at UI. It was launched by John Menninger in 1974,





## WE REMEMBER... *We Remember...*

**Dennis Oliver** retired in 1997 after a long career as Professor and Director of the UI Physicians Assistant (PA) program. He was also Head of the Associated Medical Sciences division of the College of Medicine. He remained active in the program after retirement, teaching PA Biochemistry and Research Methods. He was very active in accreditation site visits for PA programs nationwide. Under his leadership, the UI PA program quickly achieved high national prominence, and usually was ranked the top PA program in the U.S.

**Dewey C. Royal** was a graduate student in our department between 1988 and 1995. He earned his Ph.D. jointly under Professors. George Cain and David Soll. What is remarkable about Dr. Royal is that he conducted the demanding research while confined to a wheel chair, suffering from steadily progressing multiple sclerosis. He was aided in much of the physical work at the bench by his devoted wife, Mary Anne Royal, who served as his research assistant throughout. He, Mary Anne and colleagues with Dr. Soll published two papers on his work here. This productivity continued in a post-doctoral appointment with Dr. Monica Driscoll at Rutgers University, where he worked on potentially neurotoxic ion channels in *Caenorhabditis elegans*. He then established his own position as Research Professor at Rutgers, continuing to study ion channels in *C. elegans* with NIH support. His untimely death occurred in June, 2009, from a medical crisis connected with MS.

**Sheldon J. Segal** received his Ph.D. degree in Zoology studying with Prof. Emil Witchsi. In the midst of a distinguished international career as a reproduction biologist, he served as the longtime Director of the Population Council of the Rockefeller Foundation, New York. He was elected to the Institute of Medicine and served as a Board Member of the Marine Biological Laboratories (MBL), Woods Hole, MA, later moving up to be MBL's Chairman of the Board of Trustees. He was given the Distinguished Alumni Award in June of 2001.

and was funded for 16 years (1975-1992) by a National Research Service Award Training Program in Cellular and Molecular Biology. Initially, this program did not admit students or grant degrees. Instead, after their first year of graduate study, students from various departments were awarded stipends based on merit. Similar to today, the students and faculty met for a weekly seminar, designed to inform trainees about the variety of research that was of interest to cell and molecular biologists, to give trainees the opportunity to present their research to a critical audience, and to provide a social connection for trainees who were working in various departments. In 1992, the Molecular Biology Graduate Program was formalized into a degree-granting PhD program, and in 2005, the program came full circle with a name change and a new NIH training grant in Molecular and Cellular Biology now headed by Dr. Bickenbach. The program is scheduled for renewal later this year.

This brief overview should suffice to exemplify the unique and important role of

the Biology Department in multiple Graduate Programs beyond its own graduate program. As we now work to revise the way we teach biology, we are making plans to continue to expand our role as leaders in education. With an increasing number of faculty in the development field, we are planning to launch a T32 application based on the original developmental biology training grant (possible title would be: Genes, Development and Evolution) with a submission anticipated for later in 2010. We also intend to strengthen our graduate student training through curricular changes. If this new initiative and, if the planned Genes, Development, and Evolution proposals are successful, the Department of Biology's graduate research will leave an even stronger mark on the graduate programs conducted at the University of Iowa.

## OBITUARIES

(Birth names in parentheses)

- Allison, (Rockafellow), Sue H. , B.A. (Zool) '32.  
Baird, John J., Ph.D. (Zool), '57  
Bandoni, Robert J., Ph.D. (Botany) '57.  
Bowen, William R., Ph.D. (Botany) '64.  
Bruner (See Lorand).  
Burns, Robert E., Ph.D. (Botany), '49.  
Caldwell (See Ryan, Margaret Caldwell).  
Clark, Ira C., B.A. (Botany), '59.  
Collins, John C., B.A. (Zool), '59.  
Debonis, (see Longbotham).  
Dixon, George L., Jr., M.D., B.A. (Zool), '50.  
Ehrenberg, Alexander, M.S. (Zool), '40.  
Engler, Robert G., M.S. (Zool), '51.  
Flanigan, Norbert J., Ph.D. (Zool) '58.  
Gordinier, Ted E., Col., B.A. (Zool), '48.  
Griffin, Mary J., B.S. (Botany) '83.  
Hunter, John K., M.S. (Zool) '53.  
Heide, Darwin R., B.A. (Botany) '60.  
Hilleman, Terry B., D.D.S.; B.S. (Zool) '64.  
Hoffman, Glenn L., Ph.D., (Zool) '50.  
Lentz, Paul L., Ph.D. (Botany), '53.  
Li, Yao-Wen Kwang, M.S. (Botany) '51.  
Longbotham, (Debonis), Mrs. Ralph, B.A. (Zool), '48.  
Lorand, Joyce A., (Bruner), Ph.D. (Zoology) '50.  
Maiden, Sydnor D., B.A. (Zool) '45.  
Mattfeld, Arnold. T. , B.A. (Zool) '35.  
McKee, Erik J., B.S. (Zool) '68.  
McKenzies (see Saari).  
Nemmer, (Schneider) Virginia E. , B. A. (Botany), '36.  
Oliver, Dennis R., Ph.D. (Zool) '71.  
Pascuzzi, Mary L., M.S. (Zool) '52.  
Pollock, John H. , B.A. (Zool) '49.  
Rademacher, Roger C. , B.A. (Zool) '67.  
Rockafellow (see Allison).  
Royal, Dewey C., Ph.D. (Biology) '95.  
Ryan, Margaret C. Ph.D. (Zool) '69.  
Saar, Richard E., M.D., B.A. (Zool) '48.  
Saari, Eunice M. (McKenzie). B.A. (Zool) '32.  
Schmatt, Charles E., B.S. (Zool.) '65.  
Schneider (see Nemmer).  
Segal, Sheldon J., Ph.D. (Zool), '52.  
Tupper, Jack W., M.D., B.A. (Zool), '47.  
Wetzel, Winston W., M.D., B.A. (Zool) '40.



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