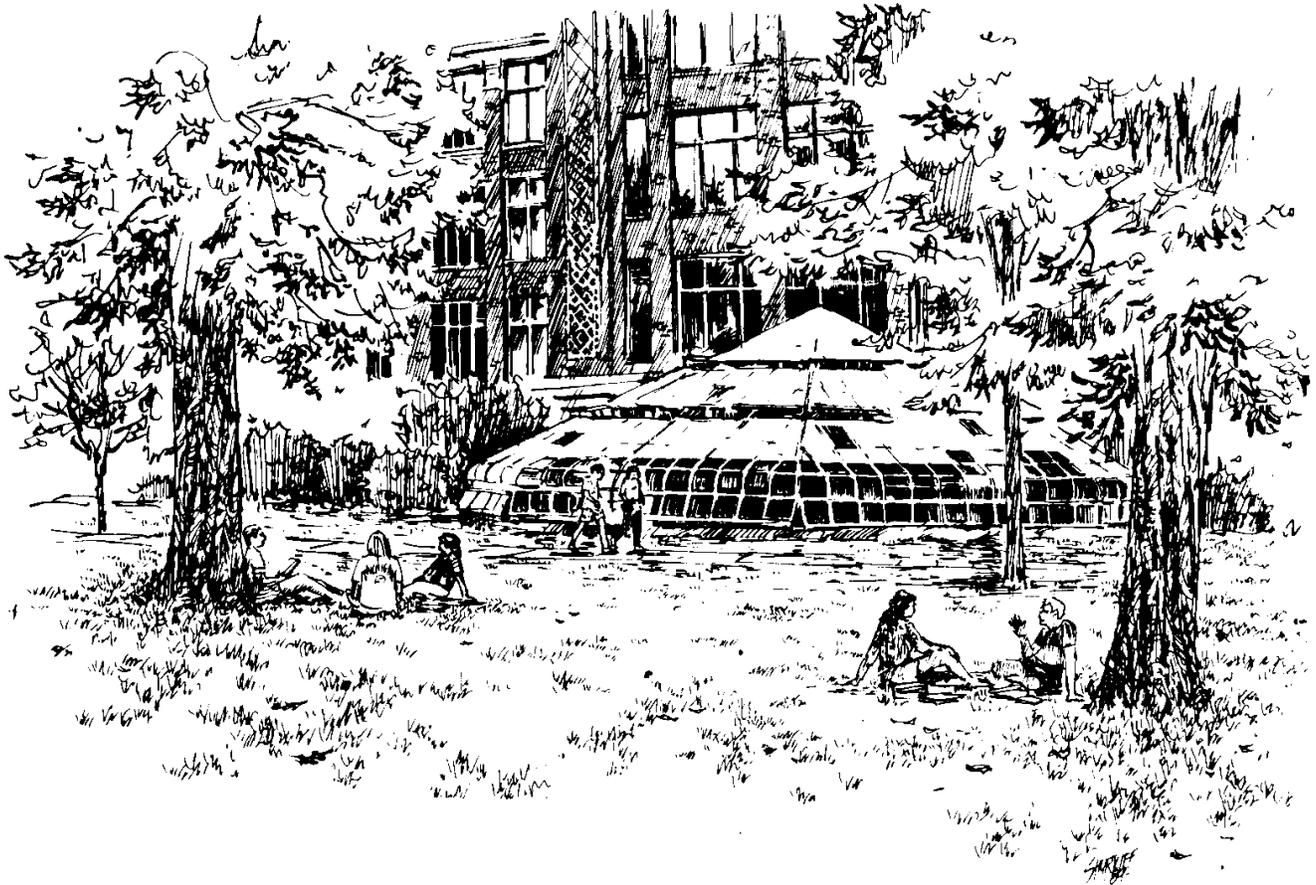

MCDB News



DEPARTMENT OF MOLECULAR, CELLULAR, AND DEVELOPMENTAL BIOLOGY UNIVERSITY OF MICHIGAN

ALUMNI NEWSLETTER

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CHAIR'S CORNER

A Message from Eran Pichersky

Those of you who received outgoing chair Julian Adams's letter at the beginning of this year know that last year the Department of Biology underwent an external review, and the clear conclusion of the committee was that Biology should be split into two separate departments that would each pursue independent research directions. Our group—comprised of researchers in the general area of sub-organismal biology—now constitutes the Department of Molecular, Cellular, and Developmental Biology. The list of faculty belonging to our Department can be found on our website, www.mcdb.lsa.umich.edu, together with a description of research and teaching activities.

We have great plans for our department. While Dean Shirley Neuman has appointed me as Interim Chair, we are in the process of searching for a new chair to be hired from outside the University. A long-term plan will be developed by the new chair together with the faculty, but it is already clear that any such plan will call for the expansion of the faculty. Currently our strengths lie in several important aspects of modern biology—protein folding and trafficking, signal transduction (in other words, how organisms convert signals from the environment or from the genes into concrete biochemical and cellular processes), and plant and animal development. In addition, our faculty brought in more than \$6M in grant money last year. However, there are some areas that need strengthening. We need to hire more people in these areas, as well as replace retiring faculty in our strong areas, in order to continue to offer the best research opportunities for our undergraduate and graduate students, as well as to keep us updated to provide cutting-edge instruction in the formal courses that we teach.

The biggest issue facing us now is our facilities. We are housed in a beautiful building—the Kraus Natural Sciences Building—that was built in the early 1900s. The building is showing its age, and some of its systems (air-conditioning, electricity, etc.) are not able to keep up with the demand of the heavy equipment many of us increasingly employ in our research. It is clear that any solution—constructing a new building or renovating and expanding the existing building—will require a major financial undertaking on the part of the University. However, it is essential for our future success that we be provided with modern facilities. If this issue is successfully addressed—and our Dean and President are laboring to come up with a good solution—then I see a very bright future for our department.

Another pressing need is support for graduate students. In the last few years, fewer and fewer students worldwide are interested in pursuing graduate programs in the sciences. The dwindling number of graduate students has resulted in fierce competition for qualified students among the graduate programs around the country. We have continued to attract top students. Our new class this year has 17 Ph.D. students and five Masters students. Our alumni contributions (see Fundraising Update, p. 7) have been crucial in this regard and will continue to make the difference.

In summary, our new department is facing major challenges, but I am optimistic that in the next few years I, or the new chair, will be able to report to you many successes.

The **MCDB News** is published by the Department of Molecular, Cellular, and Developmental Biology at The University of Michigan, Ann Arbor, MI 48109-1048.

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FACULTY HIGHLIGHTS

Departmental notes and news

Julian Adams completed five years as Chair of the Dept. of Biology and is currently a visiting professor at the University of Grenoble in France. His research, together with that of John Schiefelbein, is featured in the latest edition of Raven & Johnson's introductory Biology text.

James Bardwell was promoted to Associate Professor.

Robert Bender was invited to address the Congress of the Chilean Microbiology Association in Punta De Tralca, Chile in December, 2000 and was Keynote Speaker for Student Scholarship Day in April of the same year.

Cunming Duan was a Plenary Lecture Speaker at the 4th International Symposium on Fish Endocrinology in Seattle, Washington in 2000.

John Kuwada has been appointed Associate Chair for Graduate Studies of MCDB.

Jianming Li gave a seminar entitled "Plant Steroid Signal Transduction" for the Biotechnology Institute at the Chinese Academy of Agricultural Sciences in Shanghai, China in February, 2001. Dr. Li also gave a seminar entitled "Steroid Signaling in Plants" at an International Plant Growth Regulator conference in Brno, Czech Republic in July, 2001.

Janine Maddock was promoted to Associate Professor. Dr. Maddock is the year 2001 recipient of the American Cancer Society Research Scholar Award.

Laura Olsen has been appointed Associate Chair for Research and Facilities of MCDB. Dr. Olsen was awarded the Amoco Undergraduate Teaching Award, Fall, 2000, and an Arthur F.

Thurnau Professorship in the Spring, 2001.

Eran Pichersky, Dept. of Molecular, Cellular and Developmental Biology Interim Chair, served as a member of the Rose Petal Genomic Initiative Advisory Board, a consortium of five groups in Israel, funded by the Israeli Ministry of Science. In November, 2000, Dr. Pichersky taught a short course in Jena, Germany for Undergraduates on Molecular Biology, Biochemistry and Evolution of Secondary Metabolism in Plants while visiting this country as a Fulbright Senior Scholar. Dr. Pichersky was also awarded a Senior Humboldt Fellowship. In 2001, Dr. Pichersky was a Forschermer Visiting Professor at the Hebrew University in Israel.

John Schiefelbein was appointed Associate Chair for Undergraduate Studies of MCDB. Two photos from Dr. Schiefelbein's research will be featured in W. W. Norton's new textbook entitled *The Principles of Developmental Biology*, and his work is featured in the latest edition of *Biology* by Raven & Johnson.

Kathryn Tosney's lab website was the featured laboratory site on *HMS Beagle*, the *BioMedNet* magazine, Issue 77, April 28th - May 11th. The site can be viewed at <http://www.biomednet.com/hmsbeagle>.

Charles F. Yocum, the Alfred S. Sussman Collegiate Professor, continues to serve as a member of the Executive Committee of the College of Literature, Science, and the Arts. ∞

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WELCOME NEW FACULTY

Dr. Ursula Jakob joined our department as an Assistant Professor September 1, 2001. Dr. Jakob received her B.S. degree in 1991 from Regensburg University in Germany, and her Ph.D. in 1995 also from Regensburg University. From 1996 until 1998 she was a postdoctoral Research Fellow at the UM with a fellowship from the German government, and from 1998 until 2001 she was an Assistant Research Scientist at the UM. Her research is on the biochemical aspects of the bacterial response to heat shock. In addition to her position as an Assistant Professor in our department, Dr. Jakob has been chosen as a "Biological Scholar" at the UM, a prestigious designation awarded by a University-wide committee. She is also a recipient of the Burroughs Wellcome Fund Career Award in Biomedical Sciences 2000. In addition, she won a Sokol Postdoctoral Award in 1998. Dr. Jakob has published extensively in her field, and is a much sought-after speaker at scientific meetings. A lab was completely renovated for her use on the fourth floor of our building, and it is already up and running.



FACULTY PROFILES

ROBERT J. DENVER and BRUCE OAKLEY



Associate Professor Robert Denver

By Kate Kellogg

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Associate Professor Robert J. Denver is investigating the amphibian stress system and how thyroid hormone regulates gene expression during brain development. He also is studying the evolution of phenotypic plasticity and the physiological ecology of metamorphosis.

In fact, his research interests range across disciplines represented within both of the new life sciences departments, demonstrating how much common ground Molecular, Cellular, and Developmental Biology shares with Ecology and Evolutionary Biology.

Less than 20 years ago, Prof. Denver was studying to become a veterinary surgeon. As an undergraduate at Rutgers University, he published his honors thesis in the *Journal of Poultry Science*. The paper's topic was the role of thyroid hormones in growth and growth hormone secretion in chickens.

By the time he had received his bachelor's degree in biology, Prof. Denver realized his chief interest was neuroendocrinology, particularly the brain-pituitary axis that controls growth and development. He joined an eminent group of comparative endocrinologists at UC, Berkeley to study hormones from an evolutionary perspective.

Although his research subjects represented every vertebrate class, his major focus was on reptiles and amphibians. "The thyroid gland controls one of the most fascinating and profound developmental events: amphibian metamorphosis," he says.

Prof. Denver set out to understand just how the brain controls production of thyroid hormones and triggers the metamorphosis from tadpole into frog. In 1988, his studies at Berkeley yielded evidence that the classic stress hormone, corticotropin-releasing hormone (CRH), controls the thyroid gland in tadpoles. In 1993, by then a postdoctoral scientist, he demonstrated that CRH can control metamorphosis.

"This finding was exciting because the fact that CRH is a stress hormone suggests that this neuropeptide could be acting as a sort of interface between the environment and an animal's physiology," Prof. Denver says.

"It showed CRH to be an important factor in the plasticity that tadpoles exhibit in their development."

Prof. Denver conducted both field and laboratory studies on the Western spadefoot toad, a desert dweller that shows extreme developmental plasticity. Hatched in ponds, desert toads will remain in the tadpole state in their aquatic habitats for up to half

a year if the food and water supplies persist. Under such ideal conditions, they can grow to a large size and presumably avoid heavy predation once they emerge as toads.

"But if things get dicey—for example, if the pond starts to dry up—they will metamorphose quickly into small toads and move into the terrestrial habitat," says Prof. Denver. "We discovered that the neuroendocrine mediator of this accelerated metamorphosis is CRH."

One of his early papers describes the role of CRH in adaptive phenoplasticity. The paper provides support for the hypothesis that CRH activates the thyroid stress axis and the animal's resulting stress response.

"What really fascinated us was that we were able to replicate the phenomenon in the lab by raising and lowering water levels in an aquarium. Until then, all the work on developmental plasticity in amphibia had been done by ecologists in the field."

Since coming to the University in 1994, Prof. Denver has included 25 undergraduates in his lab work, many of whom have gone on to graduate and professional schools, and has published several papers with these students. "It's been a real pleasure to interact with the undergraduates here, particularly upper-level honor students who often get really excited about a research topic," he says.

He also is intrigued by evidence that humans and other mammals use CRH as a developmental cue to time the length of the gestational period. Researchers have found that the umbilical cord blood of premature infants has a greatly elevated blood concentration of CRH.

"That's leading many people to hypothesize that a stressful environment in the womb elevates fetal CRH, which in turn signals to the mother that it is time to initiate labor," says Prof. Denver.

A March, 1999 article in *Scientific American* describes how this knowledge may lead to the ability to diagnose women who are at risk for premature spontaneous labor. The article cites Prof. Denver's work with the spadefoot toad and his findings that CRH's control over development may have evolved before mammals appeared.

"I suggest this represents a biogenetically ancient developmental cue that allows developing fetuses or larvae to monitor the quality of the environment and respond accordingly," he says. "A major focus of my research is to understand the structural and functional evolution of this signaling system and its role in development."

Reports of global declines in amphibian populations and high incidences of deformities have prompted researchers to investigate environmental factors that function as stressors to these animals. Prof. Denver and his former dissertation student Karen Glennemeier recently published a paper on the effects of polychlorinated biphenyls (PCBs) on the amphibian stress axis.

"While studies have been done on mammals, birds, and fish, virtually nothing was known about the impact of PCBs and other environmental influences on amphibians," he says. "Although production of PCBs was stopped in this country in the late 1970s, they persist at high levels in the environment and pose a potential threat to humans and wildlife."

Prof. Denver most recently discovered that some classes within the 206 varieties of PCBs affect only the mammalian thyroid system and others influence amphibians. "The explanation

is that the hormone-binding proteins of mammals and amphibia have completely opposite specificities for various sets of molecules. Where one set of molecules disrupts the endocrine function in amphibia, the same set wouldn't necessarily affect mammals," he explains. He will be publishing some of these findings this fall.

He also is very interested in how the hormones of peripheral endocrine glands, particularly the thyroid, bring about maturation of the brain during fetal, larval and postnatal development.

"The best example for understanding the importance of the thyroid hormone's role is the condition of severe mental retardation called cretinism," he says. "Cretinism results from thyroid deficiency in humans during fetal and postnatal life."

Prof. Denver studies thyroid hormone's effect on the developing brain from both a neurodevelopmental and molecular gene regulation perspective. "We're combining a gene discovery approach with functional analysis to develop methods to study the function of proteins that support brain development. Our primary model for these studies is *Xenopus laevis*, the African clawed frog."

One of his methods is a gene transfer approach where he microinjects DNA in a tadpole's brain ventricle and then passes an electric current across the head. The DNA then goes into one side of the brain, allowing him to mis-express and manipulate genes.

The gene discovery approach uses DNA micro arrays to discover genes that are hormone-regulated in the brains of both frogs and mice.

"I think of my research as completing a circle," says Prof. Denver. "I started out wanting to know how the brain controls production of hormones and how the environment influences neurohormone production. Completing

the circle is my interest in how those hormones produced by the thyroid and adrenal glands bring about maturation of the brain."

Prof. Denver's research is currently supported by grants and fellowships from the National Science Foundation, the National Institutes of Health, the American Thyroid Association, and the Michigan State Department of Environmental Quality, among other grant-making agencies.

In addition to pursuing his many research interests, Prof. Denver teaches courses on animal physiology and endocrinology. Outside the lab and classroom, he is an avid scuba diver, mountain biker and backpacker.



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Professor Bruce Oakley

By Kate Kellogg

After 35 years of productive research and teaching at Michigan, Professor Bruce Oakley is still excited by the scientific challenges and opportunities awaiting him and those who will follow.

This neurobiologist has been a Biology faculty member since 1966. While the Ph.D. he received from Brown University was in biological psychology, he decided to concentrate on

continued on next page

biology. “It seemed the most promising discipline,” he says. “New techniques allow proliferation of information, making research enormously productive.”

During a postdoctoral stint in Stockholm, Prof. Oakley conducted experiments that related human perceptions of taste to responses from taste nerves. He showed that the adaptation to salt works at the level of nerve receptors and is not an adaptation of the brain.

Later work at the University of California, Los Angeles launched his interest in the development of taste buds as a model sensory system. Most of his subsequent work has been in that area.

His main research interests are olfaction and taste and factors that control cell death and survival. In the olfaction area, he worked largely with salmon and trout. One of his major findings was that olfaction, unlike vision, touch and other sensory systems, works by way of a convergent projection system.

The projections to the brain from receptors in the nose are unlike most other sensory systems, in that each type of olfactory receptor is widely scattered throughout the nose. Such receptors converge their axonal projections to a particular part of the olfactory system.

“The likely reasons for this convergent projection are to insure that any small patch of receptors can discriminate among odors and to provide amplification,” Prof. Oakley explains. “Because the receptors are widely distributed, if any part of the nose becomes damaged or infected, receptors of a given type will still function somewhere else. And convergence of all receptors of one type to a particular point will amplify the signal.

“It was fun to discover this, since scientists, including the Nobel Prize win-

ner Lord Adrian, had assumed for 40 years that the olfactory projections worked as they do in the visual system.” Since Prof. Oakley’s 1991 discovery with David Riddle, molecular genetics approaches have confirmed his observation.

He is currently conducting research on the sense of taste with induced mutant mice, or “knockout” mice, in which one gene has been inactivated. Choosing genes thought to affect development and function of the taste system, he has shown that developing taste buds require innervation. If the taste axons don’t get into the tongue, taste buds don’t develop, Prof. Oakley has found.

“That is an experimental solution to what people thought for a century but couldn’t prove—that mammals’ taste bud development is nerve-dependent. We disproved the speculation that taste buds can arise in mammals without nerve fibers, as they do in salamanders.”

His work with these knockout mice shows how heavily taste development depends on Brain-Derived Neurotrophic Factor (BDNF). BDNF is one of four chemicals that support developing neurons. A BDNF knockout mouse—one whose BDNF gene has been inactivated—will lose its taste neurons, and its taste buds will never develop, Prof. Oakley has found.

He is now currently “on a hunt” for other molecular factors in the tongue that might be important for taste bud development and will soon publish an article on Epidermal Growth Factor Receptor. One of EGFR’s many roles is development of those taste buds in the front of the mouth.

Still another key player in the nerve growth story is the receptor called p75, Prof. Oakley explains. This receptor will bind to all four nerve growth factors and is essential to normal taste bud development, as demonstrated in p75 knockout mice experiments. Prof.

Oakley believes it helps provide BDNF to taste nerve fibers, perhaps binding with BDNF or making it more easily available to nerve fibers as they grow into the tongue.

“The problem is not having a shortage of things to do, but so many possible factors to investigate,” he says. “We guess there are a dozen chemical factors that play significant roles in taste bud development. This is an exciting time for this research because molecular genetics has created so many opportunities to explore the development of sensory receptors and neurons in the taste system.”

Prof. Oakley is also involved in research in another hot area of biology—mapping the gene cascade that leads to cell death. This research expands upon “the notion that cells have elaborate genetic programs to kill themselves, either because they are under stress or have short life spans,” he says.

Taste cells, which live about ten days, are replaced through a continuous turnover that requires programmed cell death when each cell has reached the end of its useful life span. Prof. Oakley has identified two genes involved in killing aged taste receptor cells.

“One of those, p53, is considered the “guardian of the genome” because it can stall cell division in a cell with damaged DNA. If the DNA cannot be repaired, p53 shunts the cell into a death pathway.

“About 50 percent of tumors have mutated p53 so there’s a lot of suspicion that p53 defects play a role in cancer. One basic cause of cancer may be that not enough cells die during epithelial turnover,” he says.

Prof. Oakley says his contribution is the finding that p53 is active in normal cell turnover as well, for it is naturally expressed in the death pathways used by aged taste cells.

In addition to his own projects, he is completing a ten-year research training program supported by the National Science Foundation. He was director of a group of 15 faculty in the Department of Biology and the Medical School—the research training group in developmental neurobiology.

“LS&A has been very generous in contributing to that support,” he says. “We’ve supported about 20 to 30 undergraduates each year. It’s been a very productive enterprise for faculty and a stimulating experience for undergraduates.”

He characterizes U-M as “a fantastic, collegial place to work. Every time I sit on a promotions committee, I’m amazed at the productivity and energy of the faculty. And I’ve always liked the breadth of the Department.”

He sees the splitting of the Biology Department as a “happy split” that gives each group a sense of mission and boost in enthusiasm for accomplishing new ventures.

He believes the Department’s interaction with the recently-launched Life Sciences Institute will take some time to develop. The focus on medical disease will eventually expand to include plant biology, ecology, and other areas. “Then it will be time for Biology to step into the limelight and take more responsibility with the initiative.

“It’s an exciting time for life sciences at Michigan and the world at large,”

Prof. Oakley adds. “But there’s a significant segment of the public that is apprehensive about what applications are about to develop from genetic research. The ethical issues are difficult and dicey. I hope we proceed with prudence.”

Prof. Oakley enjoys interacting with both undergraduates and graduate students and teaches two courses in neurobiology. He has found that undergraduates, including pre-med students, are quite responsive to basic research “even when it has no direct application to their medical careers.”

His children are likewise intrigued with biology. Ingrid is finishing her Ph.D. in epidemiology at Stanford, and Brian is completing his dissertation research in forestry at the University of Washington.

Among his personal interests is an affinity for the Yucatán Peninsula of Mexico—both for its pristine coral reefs and for its indigenous people. He and his wife, Deborah Oakley, a U-M Professor of Nursing, are supporting a library for the Mayan residents of Akumal.

Always the investigator, Prof. Oakley also explores the area’s coral reef—an extension of the Brazilian reef—and hopes to publish his findings about the biological niches he is studying there.

In contemplating biology and his upcoming retirement, he says simply, “If I had it to do all over again, I would.” ∞

FUNDRAISING UPDATE

By Eran Pichersky

Splitting of the Department of Biology made it necessary to separate the endowment funds as well. Some endowments were easy to separate. The fund that began a few years ago specifically to support MCDB graduate students was, of course, transferred in full to MCDB. I am happy to report that additional donations to this fund last year totaled \$16,930, a most useful addition to a fund crucial to increasing the number and quality of our students.

Other endowments were deemed appropriate either to MCDB or EEB. When in doubt, we always contacted the donors, if possible. Other endowments were designed to support graduate students or faculty who may be working in either department, so we allotted an equal portion to each department.

A noteworthy event, described in detail on p. 13, took place on April 24th, 2001. Professor Günter Blobel of the Rockefeller University, the Nobel Prize winner in Medicine and Physiology of 1999, gave the first Priscilla Connell Memorial Lecture. The Priscilla Connell endowment was established with her husband Paul Connell’s generous donation. Mr. Connell has instructed the University to transfer his entire endowment to MCDB so that we may continue to host many distinguished guests for years to come. ∞

NONDISCRIMINATION POLICY STATEMENT

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BIOLOGY 401—EXPLORING THE FOREFRONT OF CELL AND DEVELOPMENTAL BIOLOGY IN GENETIC MODEL SYSTEMS IN THE ERA OF THE SEQUENCED HUMAN GENOME

Biology 401, coordinated by Prof. Rolf Bodmer, and offered for the first time by MCDB last winter, was a huge success. The format of this course was rather unusual: Every other week, an internationally distinguished researcher visited us here in the Nat Sci building, spending almost a week in residence at the University. During their stays, these scientific leaders delivered lectures, conducted discussion sessions, and met individually with students. In the week preceding the visit, the students were introduced 'in-house' to the model system represented by the visiting scholar. The response from students taking this course for credit was quite overwhelming, generating praise that is quite rare these days. Some of the comments from students were: "This course is a great one." "This has been the most informative, most interesting class I have taken here at U of M." "This was probably the best course that I have taken at the University." "Nice chance to actually apply all the stuff we've learned in past classes." "It was a culmination of many areas of biology that have been covered in my four years of biology here." "I enjoyed the class, and it was one of the best courses I have taken to date." Not only the enrolled undergraduates, but graduate students, postdocs and faculty alike very much enjoyed the various opportunities to interact with these eminent scientists. This departure from formal classes and exams was received as a very refreshing experience complementary to traditional studies.

The intention was to cut across a wide range of interests and uses of model systems in our department, and to offer the students a first-hand exposure to the thinking of leaders in their respective fields of cell and developmental biology. Prof. Bodmer says

that he hoped to enable the students to get a realistic sense of how science is done in molecular-genetic model systems, to include getting a real sense for their strengths and weaknesses. Although an experiment, it seemed to have worked: the students not only took full advantage of this unique learning opportunity, but also had fun doing it.

Instrumental to this task was the good fortune that we were able to attract six of the top leaders in their fields.

January 22-25: Dr. William Gelbart, Harvard University, Cambridge, MA, is one of the founders of modern developmental genetics and genomics using the fruit fly, *Drosophila*, as a model system. He made seminal contributions to defining the role of TGF-3 during development. His current research focuses on designing novel approaches to study the fly genome.

February 5-8: Dr. Martin Chalfie, Columbia University, New York, is one of the pioneers in studying combinatorial genetic and transcriptional control mechanisms of cell fate specification, using the nematode worm, *C. elegans*, as a model system. His genetic screens provided fundamental insights into the progressive stages of nerve cell differentiation. He also introduced the universally used molecular tag GFP to us.

February 19-22: Dr. Ira Herskowitz, UCSF, San Francisco, a National Academy of Science member, spearheaded our understanding of signal transduction mechanisms and asymmetric divisions controlling cell-type selection, using yeast as a model, the first eukaryotic system available for genomics studies. Ira Herskowitz: "Yeast can do practically everything, except shoot hoops!"

March 12-15: Dr. John Rubenstein, UCSF, San Francisco, uses the knockout genetics and other transgenic tools available in the mouse system to study the development of the nervous system. He has contributed seminal work to our understanding of how the vertebrate brain is patterned during embryogenesis.

March 26-29: Dr. Joseph Ecker, Salk Institute, San Diego, has done seminal work elucidating the ethylene signal transduction pathway in plants and in establishing *Arabidopsis* as a genetic model system of development. Currently he is one of the driving forces in the *Arabidopsis* genome project.

April 9-12: Dr. Charles Kimmel, University of Oregon, pioneered and established zebrafish as a vertebrate genetic model system of development. He has not only laid the foundations of zebrafish embryology, but elucidated a plethora of genetic functions involved in axial patterning and organogenesis in zebrafish. ∞

GRADUATE STUDENT PROFILE



Aaron Liepman

By Kate Kellogg

Aaron Liepman first discovered his appreciation for plants through his work as an undergraduate lab assistant for Biology Professor Larry Noodén. By the time Liepman graduated in 1996, he was also getting hooked on molecular biology.

In the course of completing his doctorate, he has reaped the benefits of numerous fellowships and awards and, as a graduate teaching assistant, has shared his enthusiasm for biology with hundreds of undergraduates.

He sees plants as fascinating natural systems and ideal research subjects. "I'm interested in understanding pathways of plant metabolism and development," he said. "From the beginning, I was amazed at how we can manipulate and study plants in ways that I would rather not do with animals. I like to be able to study a living thing objectively without necessarily hurting it."

Liepman's current research, focused upon a metabolite recycling pathway specific to plants, led to discoveries

that may someday help to increase crop productivity. He and his dissertation advisor, Associate Professor Laura Olsen, published results of this research in *Plant Physiology* (1998) and *The Plant Journal* (2001).

The research problem involves photorespiration, a metabolite recycling pathway that costs plants much of the energy generated in photosynthesis. Liepman achieved a breakthrough by identifying and isolating genes that encode two of the central enzymes within this pathway.

Photorespiration is necessary because of the dual activity of an enzyme that allows plants to fix carbon dioxide, resulting in the production of sugars.

The downside of this enzyme is that it sometimes reacts with oxygen instead of carbon dioxide, and this reaction produces metabolites that are not photosynthetically useful. The photorespiratory pathway converts these products into useful metabolites.

Using the plant *Arabidopsis thaliana*, he isolated genes encoding aminotransferase enzymes responsible for at least two of the steps of photorespiration that take place in plant peroxisomes.

Liepman selected *Arabidopsis* for his experiments because this model plant species is amenable to lab studies of plant molecular biology and physiology. Recently, the genetic code of this small "weed" was completed, making it the first plant species with a fully sequenced genome. Studying the sequence data of the *Arabidopsis* genome helped Liepman identify the genes that encode these key proteins in photorespiration.

Liepman has enjoyed teaching undergraduate courses ranging from 100 to 400 levels. "The younger students

contribute their enthusiasm, and the older students challenge me with tough questions about specifics," he said. "I hope to teach more in the lab and help train future researchers during and after my postdoctoral work."

Liepman also appreciates the generous grants he has received through the University and Biology Department. From the Department, he received seven graduate teaching assistantships, a dissertation thesis award, and the Emma J. Cole Fellowship for distinguished achievement in botany. The Department also awarded him three Newcombe Fellowships for summer research in plant physiology and the Sam Mitchell Memorial Award for outstanding accomplishment in Molecular, Cellular, and Developmental Biology.

The Mitchell Award includes an honorarium to present an annual research lecture to the Department. "This provided a good opportunity for me to talk about my research before a large audience," Liepman said.

He also received a three-year fellowship from the Cellular Biotechnology Training Program and a one-term fellowship through the Rackham Graduate School for the current Fall Semester.

U-M will lose Liepman at least for a while as he pursues postdoctorate studies at Michigan State University. But he doesn't rule out the possibility of returning, once he has completed this work.

"I have had fun here and enjoyed working with the great people in this Department," he said. "The plant biology group is small, but strong and growing. At the same time, the breadth of research at the University offers many opportunities for collaborative work." ∞

GRADUATE STUDENTS IN THE NEWS

Brody DeYoung (Clark) and **Marissa Simon** (Schieffelbein) were each awarded a three-year fellowship from the **Cellular Biotechnology Training Program** (CBTP). Students in this NIH-funded program are drawn from a number of departments, which include Cell and Developmental Biology, Bioengineering, Biological Chemistry, Biology, Chemical Engineering, Chemistry, Civil and Environmental Engineering, Human Genetics, Microbiology and Immunology, and Physiology. Appointment to CBTP is through individual departments.

Cong Yu (Li) was awarded the **Emma J. Cole Fellowship**, given to graduate students who are pursuing special studies in the area of Botany and have given evidence of distinguished attainment.

Tanya Johnson (Olsen) and **David Parker** (Cadigan) were awarded a **Pre-doctoral Genetics Training**

Grant Fellowship. The Genetics Training Program is an NIH-funded predoctoral training program which has been in place at the University of Michigan for 42 years. This is a multi-departmental program that draws its strength from the excellence and diversity of its faculty and students within the area of genetics and from the wealth of resources that the University of Michigan has to offer.

Brody DeYoung (Clark), **Tanya Johnson** (Olsen), **Aaron Liepman** (Clark), and **Jeannine Ross** (Pichersky) were the recipients of **Newcombe Fellowships**. These fellowships are awarded to graduate students in support of research in Plant Physiology. Funding comes from a departmental endowment.

Sean Friday (Nichols), **Jennifer Fuentes** (Maddock), and **Patrice Malone** (Maddock) obtained **Rackham Merit Fellowships**. This fellowship program was established to

support entering graduate students at the University of Michigan, Ann Arbor, who are members of racial and ethnic groups historically under-represented in graduate education in the United States.

Tong Xiao (Kuwada) and **Aaron Liepman** (Clark) were supported by **Rackham One-Term Fellowships**, which consist of candidacy tuition and registration fee plus a stipend for one term. These Fellowships are awarded to students who are at the writing stage of the dissertation and are intended to speed the process of completion. The awards allow candidates to work full-time on the final stages of their dissertations.

John D'Auria (Pichersky) was awarded a **Rackham Predoctoral Fellowship**, given to outstanding students who will complete the dissertation in the year in which they hold the fellowship and who will complete the doctorate within six years of beginning their programs. Selected from approximately 200 nominations from all over campus, 60 Rackham Predoctoral Fellowships are available each year.

Aaron Liepman (Clark) won the **Samuel J. Mitchell Award**. Given for outstanding research accomplishments, the awardee presents a research lecture; "The Samuel J. Mitchell Lecture 2001" to the Department.

Kirsten Green (Clark) received the **Angeline B. Whittier Fellowship**, presented to graduate students in Botany for summer support and/or research expenses.

Tanya Johnson (Olsen) and **Brody DeYoung** (Clark) received the **Youngman Award**, endowed for the benefit of students studying in the areas of plant physiology and molecular biology. ∞

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RECENTLY AWARDED GRADUATE DEGREES

Ph.Ds

Winter 2001

Dennis Lavrov completed his dissertation entitled "Arthropod Phylogeny Based on Gene Arrangement and Other Characters from Mitochondrial DNA."

Mentor: Dr. Wesley M. Brown

Spring/Summer 2001

Yan Lin completed her dissertation entitled "The Role of GLABRA2 (GL2) in Root Epidermis Development in *Arabidopsis Thaliana*."

Mentor: Dr. John W. Schiefelbein, Jr.

Master's Degrees

Winter 2001

Kathleen Berry
Min Chul Cho
Robert Hopkins

Spring/Summer 2001

Sarah Kern
Roger Romanick
Jacqueline Tan

2001 UNDERGRADUATE HONORS RECIPIENTS

Biology Concentrators

High Honors

Audrey Baker

Phylogenetic Analysis of the Avian Orders Piciformes and Coraciiformes using Mitochondrial DNA Sequences
Mentor: David P. Mindell

Honors

Rebecca E. Diener

Sexual Response to Auditory and Visual Cues in a Parasitic Finch (*Vidua chalybeata*)
Mentor: Robert B. Payne

Kiersten J. Meacham

Distribution of the Cell Surface Rib Protein of Group B *Streptococcus*
Mentor: Betsy Foxman

Lin-Fan Wang

The Effects of Cysteine Mutations on P2X2 Receptor Function
Mentor: Richard I. Hume

CMB Concentrators

Highest Honors

Brian J. DeBosch

Effects of Insulin-like Growth Factor-I on Retinal Endothelial Cell Glucose Transport and Proliferation
Mentor: Arno K. Kumagai

Danielle E. Turner

Remote Delivery of Adenoviral Gene Therapy within Rat Central Nervous System
Mentor: Eva Feldman

High Honors

Christina M. Duzyj

Activated Human B Lymphocytes Express T Lymphocyte Cell Surface Antigens
Mentor: David A. Fox

Honors

Matthew A. Armfield

Iron Deficiency Anemia During Early Rat Development: Effects on Myelin Ultrastructure in the Optic Nerve
Mentor: Barbara T. Felt

Honors

Sam Lahidji

Investigations of Retinoic Acid and Epidermal Growth Factor in Porcine Proximal Tubule Cell Culture
Mentor: H. David Humes



EXTERNAL GRANTS AWARDED TO MCDB FACULTY IN 2000–2001

C. Duan	NIH	IGF-I and Its Binding Proteins in Vascular Smooth Muscle Cells
R. Hume	NSF	Role of P2X and P2Y ATP Receptors in Neuromuscular Junction Development
U. Jakob	Burroughs Welcome Fund	Structural and Functional Characterization of New Heat Shock Proteins
J. Maddock	American Cancer Society	Cell Polarity and Chemoreceptor Clustering
E. Pichersky	USDA	Phenylpropene Flavor Compounds in Basil: Biosynthesis and Regulation
E. Pichersky	State of Michigan	Applied Chemical Ecology for Pest Management Alternatives
J. Schiefelbein	NSF	Molecular Genetics of Cell Patterning in the <i>Arabidopsis</i> Root Epidermis
J. Schiefelbein	USDA	The Role of bHLH Genes in Root Epidermal Cell Specification
G. Wilson	NIH	Modulation of Potassium Channels in <i>Drosophila</i>

ALUMNI NEWS


**DAVID RAMSEY
(MS '54)**

David Ramsey resides in Rio Verde, Arizona. His current occupation is founded on his love of wood, learned in 1954. The photo shown is a creation entitled "Thunderhead." In actual size it is 9" x 23" and is a beautiful example of the wood designs he creates.

**JOSEPH A. MAJZOUB
(BA '70, Zoology)**

Joseph A. Majzoub, Associate Professor of Pediatrics, Associate Professor of Medicine, Harvard Medical School and Chief, Division of Endocrinology, Children's Hospital writes to state that his experiences at University of Michigan were "very stimulating" and contributed greatly to his pursuit of a career in Biological Sciences. Professor Allen (former Biology Dept. Chair and Emeritus Faculty member), Professor Frye, Professor Tinkle, Professor Maynard and Professor Staehelin were among the faculty who inspired Dr. Majzoub during his time at the University of Michigan.

Dr. Majzoub's current research interests include the mechanisms and consequences of responses to stress, including how fetal responses to intrauterine stress affect fetal maturation and the timing of birth. Dr. Majzoub sends his appreciation and his hope that the University and the Dept. will continue to inspire today's students as he was inspired.

**JONATHAN MONROE
(BS '83)**

Jonathan Monroe has recently been honored with the distinguished Excellence in Teaching Award by the American Society of Plant Biologists. The award was presented to Dr. Monroe in recognition of his commitment at the local, regional and national levels to engage students of all ages in the science of Plant Biology. An Associate Professor of Biology at James Madison University since 1992, Dr. Monroe teaches a wide range of courses, including Molecular Biology, Cell Biology and Plant Physiology. He is exceptionally innovative in the teaching laboratory and designs labs that are motivated by student inquiry. In addition to his dedication to education, Dr. Monroe runs a productive, federally funded research laboratory that is currently involved in a research program that deals with the structure and function of alpha-glucosidases from *Arabidopsis thaliana*. This research is focused on understanding the molecular structure and physiological function of various alpha-glucosidases in plant tissues. More than 20 students have participated in the research in Dr. Monroe's lab, and many of them have chosen careers in the field of research. Dr. Monroe's colleagues note that "he fosters a culture of excellence, and the expectation to do less is not to be sufficiently engaged. He takes risks [in his teaching] - risks that are rewarded in kind with student insight, comprehension, growth and motivation."

Beyond JMU, Dr. Monroe is a leader in education, both regionally and nationally. He has served as volunteer laboratory instructor at local high schools, administered educational exercises in plant biology for elementary level schools, and served

as an instructor for the Virginia Native Plants Society. He has been a councilor at the Council on Undergraduate Research (CUR) since 1996 and is currently on the CUR Executive Committee and Chair of the CUR Biology Division. Dr. Monroe is the founder and co-discussion leader of "Plant-ed" newsgroup, a worldwide resource for exchanging information and ideas for teaching Plant Biology. Dr. Monroe is additionally active in the Washington Area Section of the American Society of Plant Biology, is a co-Chair of the Primarily Undergraduate Institute Working Group and was a co-developer of the ASPB Summer Undergraduate Research Fellowship Program. Dr. Monroe's work has been fundamental to building a broad community of educators in plant biology from the introductory classroom to the research laboratory.

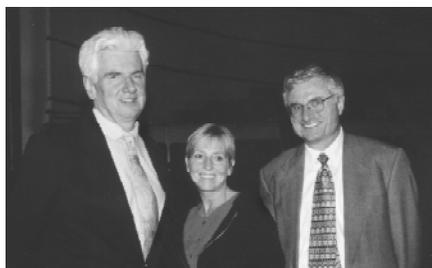
**JOSÉ J. TERRASA-SOLER
(MS '92)**

José J. Terrasa-Soler has been named Manager of the Environmental Business Unit at CSA Group, Inc., San Juan, Puerto Rico. CSA is the largest Hispanic consulting firm in the U.S., offering full services in engineering, architecture, and environmental sciences. With over 500 employees, CSA is headquartered in San Juan, Puerto Rico, and has branch offices in Cincinnati, Philadelphia, Atlanta, and Miami. José now leads all of the environmental services offered by CSA. The Environmental Business Unit offers full environmental services in environmental engineering, environmental sciences, and environmental permitting and compliance.


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If you are interested in having your profile printed in the MCDB Alumni Newsletter, please reply to MCDB.Alumni@umich.edu.

THE FIRST ANNUAL PRISCILLA CONNELL MEMORIAL LECTURE



Dr. Günter Blobel, Pamliä Grafe, and Prof. Julian Adams

April 24th was an auspicious day for the Department, as it was the date of the inaugural Priscilla Connell Memorial Lecture. Dr. Günter Blobel of the Rockefeller University, who received the Nobel Prize in Physiology or Medicine in 1999 for his work in cell biology, was the invited speaker. His lecture attracted a standing room only audience in the Rackham Amphitheater, attended by researchers and stu-

dents from all over the University of Michigan campus, as well as by Ms. Connell's daughter, Pamliä Grafe. Dr. Blobel's talk was an historical perspective of his laboratory's research on a fundamental question in cell biology, namely: How does a cell organize its myriad proteins so that it can function and divide? Specifically, his efforts have focused on how newly synthesized proteins in the cytoplasm become positioned in their correct subcellular locations - such as the endoplasmic reticulum (ER) membrane. His "signal hypothesis," first postulated in 1971, stated that proteins must have short sequences of specific amino acid "signatures," which direct them to be inserted into the ER. This concept was confirmed in Dr. Blobel's lab over the next several years using elegant and innovative biochemical techniques. Many of the basic molecu-

lar mechanisms of the process were subsequently discovered by his group. The lecture was a wonderful opportunity to hear the story firsthand from the person most responsible for our current understanding of the process. Dr. Blobel organized his talk around the contributions of his students and postdoctoral fellows who made significant contributions. Many of the people mentioned have moved on to have very successful academic careers of their own. Members of the audience who took courses in cell biology after 1980 were surprised to learn that Blobel's model was initially met with skepticism and opposition among many prominent scientists. It was a nice reminder of how researchers have to believe in their results, but also have to have the determination to provide enough evidence to convince all doubters. ∞

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GÜNTER BLOBEL

Dr. Günter Blobel's research addresses the fundamental question of how newly synthesized macromolecules reach their proper cellular compartments. His "signal hypothesis," first postulated in 1971 with David Sabatini, stated that secretory proteins must have specific N-terminal amino acid residues which direct them to be inserted into the endoplasmic reticulum membrane. This concept was confirmed in Dr. Blobel's lab over the next several years using elegant and innovative biochemical techniques, and many of the basic molecular mechanisms of the process were subsequently discovered by his group. This beautiful body of work has served as a paradigm for what we now refer to as the molecular analysis of cellular function.

In addition to this seminal work, Dr.

Blobel has investigated several other aspects of intracellular protein trafficking. He has a long-standing interest in how macromolecules enter and exit the nucleus through the nuclear pore complex, which his lab studies intensively, using both yeast and mammalian cells. He has also published many papers on the translocation of proteins across the bacterial plasma membrane and the membranes of chloroplasts and peroxisomes.

Dr. Blobel was born in 1936 in the small Silesian village of Waltersdorf, then in the eastern part of Germany, now part of Poland. His childhood was marked by the turbulent events of WWII and subsequent life in communist East Germany. In 1962 he traveled to Madison, Wisconsin, where he obtained his Ph.D. in the lab of Van R. Potter. After graduating in 1966, he

joined the laboratory of the great cell biologist George



Palade at the Rockefeller University. In 1969, he was appointed to the faculty at the Rockefeller, where he currently resides. In 1986 he was appointed as a Howard Hughes Medical Institute Investigator, and since 1992 he has held the position of John D. Rockefeller Jr. Professor.

Among his many awards and honors, Dr. Blobel was elected to membership in the U.S. National Academy of Sciences in 1983 and received the 1993 Albert Lasker Basic Medical Research Award. In 1999, Dr. Blobel received the Nobel Prize in Medicine or Physiology. ∞

PRISCILLA HARRISON CONNELL

Renowned commercial photographer Priscilla H. Connell gained her love of nature while growing up on a farm in Clermont County, Ohio. She eventually married and raised children, but the love of nature she had developed as a child never waned. She discovered her talent for photography after her children entered high school, and this led to her long and distinguished career as a nature photographer.

Her photos have appeared in Sierra Club and Audubon Society magazines and calendars and have been extensively featured in books and

other prominent publications. She was presented a Roger Tory Peterson award for her work, and the U.S. Postal Service selected one of her photos for a series of four "Tropical Flowers" stamps. Her work has been exhibited at the Cincinnati Nature Center, which she avidly supported, and at the University of Michigan.

Mrs. Connell was married for 50 years to Paul Connell, who earned a Bachelor of Science degree in mechanical engineering from the University of Michigan. The family lived in Ann Arbor while Mr. Connell was a student, and then moved to the Cincin-

nati, Ohio area where Mr. Connell worked as an engineer and taught high school physics.

In 1998, a book of her photographs was published under the title *Natural Impressions of Priscilla Harrison Connell*. It was compiled, designed, and edited by two of her children, Pamliia Connell Grafe and Philip Connell.

Her passion for nature photography resulted in the establishment of a very generous endowment by her husband, Mr. Paul Connell. ∞

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