IN VIVO

Newsletter of the University of Tennessee Division of Biology

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From the Director

Otto J. Schwarz, Ph.D.

Seasons Greetings... With this issue of IN VIVIO we close out 2003 and look forward to the renewal brought by the coming New Year. This past fall semester has come to a galloping close and with it the graduation of **Dr. Anjana Sharma**, most probably the last graduate student I will have the pleasure to guide.

My research laboratory has been active for some thirty years and has been the temporal home of a group of wonderful folks, both undergraduate and graduate students, and post doctoral associates. The only thing that I regret is that I was never able to overcome my lack of office/desk organization. Just think, 33 years of accumulated clutter, not a pretty sight.

Ahh, Mother Nature has chosen to save me from these thoughts as outside my office window it has begun to snow. Those of you fortunate enough to have witnessed an East Tennessee snow can join me in memory when you recall the white-clad quiet beauty of the hills and mountains that surround the University.

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Botany's new kid on the block

The Department of Botany welcomes its newest member, Assistant Professor, **Dr. Joe Williams**. He grew up in a village near Tehran, Iran while his father was in the pipeline business. He then spent his teenage years back in the states in Oklahoma before getting his undergraduate degree in Fine Arts from Stanford University in 1981.

His strong interests in natural history originally led him to undertake a Master's degree in ornithology at New Mexico State University. There he met several influential botanists who interested him in plant ecology and evolution. He received his Master's in Biology in 1994, after initiating a project on desert oaks that is still ongoing.

He then went on to pursue his Ph.D. in the department of Genetics at the University of Georgia. While there he concentrated on the population genetic aspects of his research. In 2000, he took a post-doctoral fellowship at the University of Colorado in Boulder with the goal of learning about the evolution of development.

His research interests are two-fold. First, he is studying the evolutionary effects of hybridization in two species of birch trees in a hybrid zone that stretches from New Mexico to Alaska through the Rocky Mountains. He is working to establish the population genetic aspects of birch hybrids found in this zone. Having already shown that the species exchange genes, he next plans to focus on examining functional traits that contribute to the fitness of the hybrids and the parent species. Dr. Williams hopes to use this as a model system for studying the evolutionary aspects of hybridization.

Dr. Williams gathering Pond lilies or *Nuphar* in a lake in the Rocky Mountains of Colorado at 10,000 feet

He said, "Scientists used to think that hybridization was a mistake or evolutionary 'noise'. Now we are seeing that hybridization generates variation for natural selection to act upon, and that closely related species can influence each other's evolution." Recent theory would show low fitness on the part of the hybrids, but he sees the opposite. In fact, in birches some hybrid populations have survived since the last ice age. Some of these populations have a genetic distinctness, and may represent the origin of new species.

His second area of research interest involves the study of the early evolution of reproductive development in flowering plants. He studies ancient flowering

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Analyzing the Operating System

by Ed Schilling, Ph.D.

A prudent businessperson knows what makes up a company's resources and how its operations work. We are now asked frequently to employ "business models" in conducting our operations at the University, and it is just a small extension to consider our collective knowledge of the world in the context of such a model.

As a society we have assembled only a very incomplete registry of the organisms with which we share our planet, and our understanding of how they work is even more fragmentary. In addition to the advances that could be made possible in the quality of life, there is a time pressure imposed by the magnitude of human impacts and their potential to destroy biotic resources that lends an added urgency to the acquisition of this knowledge. Research in the Department of Botany is actively seeking to fill in the gaps in this information, particularly as it relates to plants and fungi, contributing to the knowledge base about how the biotic world operates.

A survey of plant species would seem to be a basic and relatively straightforward proposition - after all, individual plants don't tend to move and can be examined and re-examined in place. Nevertheless, we are still turning up new species that are native to Tennessee.

For example, work by graduate student **Dwayne Estes** has revealed the existence of two heretofore unnamed species of plants that are native to barren or outcrop habitats in the southeastern U.S. The UT Herbarium serves as a critical resource to allow such work to proceed, providing a permanent record of plants and where they have been found that serves as a baseline for continued research.

Even less well known than plants are the fungi, where the organism spends most of its life cycle out of sight in the soil or in decaying organisms. The collaborative research of **Drs. Karen Hughes** and **Ronald Petersen** is illuminating many aspects of basidiomycete fungi (mushrooms), including the revelation of previously unrecognized species and the clarification of the geographic distributions, including ideas on how these distributions might have been achieved (see accompanying article, page 5). Critical to this research is the combination of expertise on genetics, culture techniques, and fungal identification that these two researchers and their students bring to the field and laboratory.

Fundamental to understanding the biotic world is knowledge of soil microorganisms such as fungi and bacteria and how they interact with plants, given the great importance of the outcomes of these interactions on soil fertility and plant productivity. **Dr. Beth Mullin** has made a research career by focusing on a group of bacteria called *Frankia* (see accompanying article, page 4). These bacteria form symbiotic associations with certain plants and are of particular interest because they have the capacity to convert nitrogen from its inert to biologically useful form ("fixation", for those of you who remember their introductory botany course material!).

Dr. Mullin and her students have been instrumental in demonstrating that all of the plants that have the capacity to form symbioses in their roots with nitrogen-fixing bacteria are part of a single evolutionary lineage - thus results from studies of any member of this lineage are likely to be generally applicable. She and her students and postdoctoral associates are busily involved in working out the details of this interaction, including specific information on the biochemical signals that let the plant and the microbe recognize one another.

Diagrams of evolutionary lineages are often portrayed as "trees" with a single trunk and simply diverging branches, although the late **Stephen Jay Gould** brought to our attention in his popular writing that lineages more closely resemble bushes than trees. Just how "bushy" a lineage can be is one of the research topics of new faculty member **Dr. Joe Williams** (see accompanying article, page 1).

His studies of hybridization between species of birches have suggested that hybridization is not just a sideshow but in many cases may be an integral part of the evolutionary process in plants. Dr. Williams' studies of the genetics of hybrids and of reproductive development of primitive flowering plants promise to provide exciting new topics for students to pursue within the department.

A common theme of each of these projects is the involvement of students making them an integral part of the educational activities of the Botany Department. The impact of each goes far beyond the simple acquisition of knowledge and forms a major part of the experience and training of students. Support for projects comes from the gift funds of the department as well as from external grant support to individual faculty members. We continue to be grateful to the generosity of our many donors who help make possible these exciting and rewarding studies delving into the operating system of this planet earth.

Note: As this piece is being written, the Department is in the process of being reviewed by a university-level group called the Review and Redirection Task Force (RRTF).

The Department was placed on the list of programs being reviewed by the RRTF because of our low numbers of undergraduate majors. This metric is only one measure of program quality, and both the quality and productivity of our teaching, research, and service activities remain high, as can be easily discerned from the stories highlighted in this newsletter. The outcome of the review process remains uncertain, but could involve a reorganization to distribute expertise in Plant Biology among the other Life Science Departments.

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WILLIAMS, *from page 1*

plants, many of which occur in the Southeast. One is the water lily, which he finds in local wetlands. Others are the Star Anise of the coast of the Gulf of Mexico, many aquatic monocots from the Southeast, the *Cloranthaceae* of Central and South America, the *Austrobaileyaceae* of Queensland, Australia, and *Amborella* of New Caledonia. He brings back samples of the plants in either dried or fixed (in alcohol) form. From the samples, he studies the pollination biology and embryology of the flowers in order to reconstruct the early evolutionary history of reproductive traits.

Dr. Williams said, "Until just five years ago it was widely thought that the magnolias and their relatives possessed the most 'primitive' traits of flowering plants. Since then water lilies and particularly *Amborella*, have been found to have originated before the magnolias, and we now are looking to these for clues about the origin of flowering plants."

Using microscopy and population genetic analyses, he studies developmental traits and breeding patterns among the plants. He said, "Unlike animals, where behavior can largely determine mating patterns, in plants mate selection is largely a consequence of development."

Flowering plants are diverse in their mating patterns, ranging from being completely asexual to highly inbreeding to completely outbreeding. When the flower originated about 130 million years ago, its male and female parts were in close proximity to each other. That means that the common ancestor of flowering plants probably experienced a high degree of inbreeding. Since then a bewildering array of mechanisms for avoiding inbreeding have evolved. He said, "My role as an evolutionary biologist is to understand some of the earliest developmental mechanisms for achieving outbreeding." He has applied to NSF for a grant to continue this research.

Dr. Williams has been at UT since August and looks forward to teaching Plant Speciation spring semester. He feels the combination of teaching and research is the best of both worlds. He said, "I couldn't be happier to be in Botany at UT. To study and teach in a place where I can interact with a full set of colleagues who understand diverse aspects of plant biology is really tremendous."

His wife, **Ana**, is finishing her Ph.D. in clinical sciences back in Fort Collins, Colorado. She should be able to join him in Knoxville next summer. She was trained as a veterinarian, but her Ph.D. research involves tissue engineering. She is currently helping to develop a heart valve for animals.

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DIRECTOR, *from page 1*

I am almost certain that today's university life has become as hectic and stress filled as that which you all must travel, so snow or no snow, take a few moments and remember the beauty and grace that has been part of your life and be at peace. This is my wish for all of our friends during this holiday season.

Last issue I blissfully related the progress of the renovation of old Hesler Hall, citing an occupation date of mid-summer 2004. Perhaps I was a bit too optimistic. Bets are now that we may get to make the move during the winter break a year from now. Actually if that date holds, I think the progress to completion will have gone well considering the enormous task of dismantling and then rebuilding the structure to modern standards. Biology is indeed fortunate to be looking forward to these new quarters.

My comments concerning our new Center of Excellence in Structural Biology unfortunately were accurate. Funding was cut from this year's state budget for CESB despite their excellent performance which is not only on track but ahead of schedule. A similar fate was met by the other Centers as well. The funds may be restored in the next

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A researcher from the very beginning

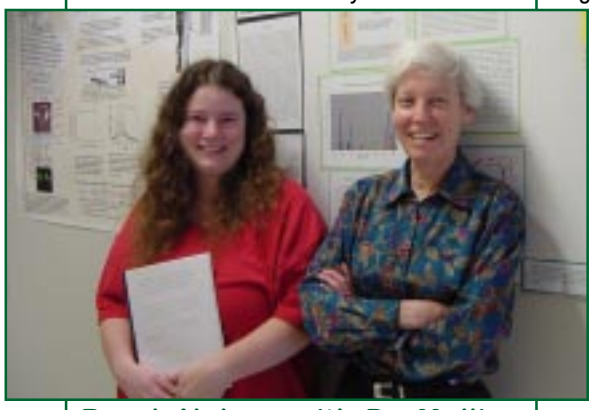
Her interest in plants began at an early age. **Dr. Beth Mullin**, professor of Botany, recalls her first experiment at age seven. She said, "I wanted to know if the phenomenon of four-leaf clovers was an inherited trait or something that occurred by chance. I found a clump of clover rich in four-leaf clovers and transplanted it to a spot where I could watch it. Unfortunately, when I went to summer camp my mother forgot to water it and I returned to find a clump of dead four-leaf clovers."

Dr. Mullin was born in Pennsylvania, but was raised in the farming community of Brookville, Indiana. She enrolled at Earlham College in Richmond, Indiana undecided about whether to major in History or Biology. For an elective she took a Field Botany course that included a collecting trip to the Great Smoky Mountains. Upon returning from that trip, she declared Biology as her major. In her junior year she began teaching freshman biology labs and thus discovered her love of teaching.

Following graduation from Earlham she moved on to do graduate work at North Carolina State University where she studied nucleotide metabolism. While there she worked in the same plant physiology laboratory as **Dr. Otto Schwarz**, who would later become her colleague at UT.

Her post-doctoral work took her in an entirely different direction. She served a four-year post at ORNL as a National Cancer Institute Fellow where she worked on RNA tumor virus replication. Her first faculty position was at Wilmington College in Wilmington, Ohio where she was hired to teach microbiology and biochemistry. She said, "I loved teaching small classes and labs and I didn't really want to leave Wilmington College, but I was engaged to **Dr. Brad Whitfield**, a genetic toxicologist at ORNL and when I was offered a faculty position at U.T. I couldn't turn it down."

With her background in biochemistry and molecular biology, she focuses on the soil actinomycete *Frankia* and its nitrogen fixing symbiotic relationship with select host plants. This relationship is of great ecological importance because it allows host plants to thrive on soils poor in nitrogen, and over time results in the development of soils that can support a wide range of species. The *Frankia* actinorhizal symbiotic system presents an opportunity to explore a beneficial plant-microbe association that differs in a number of fundamental ways from the rhizobial/legume symbioses. Molecular analysis has led to a hypothesis that both actinorhizal and legume symbioses evolved within a single clade of plants predisposed to participate in nitrogen-fixing symbioses and it is within this framework that Dr. Mullin is attempting to identify genetic factors that might lead to this predisposition. One gene of interest first identified in Dr. Mullin's lab codes for a glycine and histidine-rich protein that is expressed in cells that are being infected with *Frankia*. Experiments are underway to determine the biological role of this protein named metallohistin.



Brook Nelson with Dr. Mullin

Discovery of metallohistins has led to an unexpected spin-off of Dr. Mullin's research. Not only might this protein be important to symbiosis, it also may be a good biosensor for heavy metals. Metallohistins bind multiple atoms of mercury, zinc and cadmium and therefore may also be useful in the development of phytoremediation systems. Plants could be engineered to absorb metals from contaminated sites.

Dr. Mullin has drawn on the expertise of a number of colleagues to accomplish her research goals. Recent collaborators include **Dr. John Dunlap** of the Microscopy Center, **Dr. Engin Serpersu** with the Center for Structural Biology & Biochemistry, Cellular and Molecular Biology, **Dr. Michael Essington** of the Biosystems Engineering & Environmental Science, and **Drs. Winston Chen** and **Thomas Thundat** of the Life Sciences Division at ORNL.

In addition to studying host plant gene expression Dr. Mullin is coordinating a genomics project on *Frankia*. As this issue of goes to press, sequencing of *Frankia* BACs has begun and as specific BAC clones are identified, they will be sent for further study to researchers around the world. It will be of particular interest to compare the *Frankia* genome to those unrelated symbiotic nitrogen-fixing rhizobial species as well as to related pathogenic and free living actinomycetes.

This past summer in addition to working with her postdoctoral associate **Dr. Olga Kopp**, now in a faculty position at Utah Valley College, Dr. Mullin hosted visiting scientist **Carol Maillet** of Augustana College and high school junior **Erika Phelps** from Maryville, both of whom worked on projects related to her current grant. She also worked with two doctoral students, **Anjana Sharma** and **Crystal McAlvin**, who successfully defended dissertations during the summer, and undergraduate **Brook Nelson** who completed a Botany Honors Thesis and is now a first year graduate student working with Dr. Mullin.

Dr. Mullin also found time to engage in one of her favorite activities, that of science education. She participated in a summer workshop in physics for middle school teachers organized by **Drs. Stuart Elston** of Physics and **Kristin Rearden** with Theory & Practice Department, and administered by **Dr. Lynn Champion** with the College of Arts and Sciences.

Beyond her work in Botany, where she teaches cell biology, advanced plant physiology, and a variety of seminar classes, and is Coordinator of Graduate Studies and Associate Head, she serves as an adjunct faculty member in Microbiology and in the Graduate School of Genomic Science and Technology (GST). Dr. Mullin is particularly grateful for the support she has received from the Botany department. She said, "I have had extremely supportive department heads and faculty colleagues here at UT. It has been a wonderful working environment for me."

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Using the team approach to study fungi

Our University has an especially rich tradition in mycology, the study of Fungi, starting with **Dean Lexemual Hesler** (for whom Hesler Biology Building is named). **Dr. Ron Petersen** was recruited by Dr. Hesler, and for the last 36 years has been studying the fungi of the southern Appalachians and beyond. Some years ago, in a remote area of China, he returned to a much earlier interest in placing mushrooms and their relatives in laboratory culture as an additional means of elucidating systematics in these fungi worldwide. This added investigations into mating systems, including the possibility of sexual compatibility of supposedly same species over wide geographical areas, to examinations of the mushrooms themselves.

Dr. Karen Hughes is a geneticist. For a number of years, she developed procedures for genetic transformation in higher plants and for regeneration of these plants from tissue culture. After a period in administration, both at UT and for NSF in Washington, she decided to return to her original interests; evolution of populations and species. A dozen years ago, Hughes and Petersen began collaboration, pairing his background in fruitbody morphology and mating compatibility and her expertise in biochemical and molecular techniques and analysis.

The result has been a series of studies involving fungal biodiversity and fungal biogeography within genera. "We feel most comfortable working with small groups of mushrooms, collected in many parts of the world," Petersen said, "and then comparing phenotypic and genotypic variation to ascertain where and when these fungal groups evolved."

Eight years ago, National Science Foundation recognized that expertise in classical taxonomy was disappearing, and instituted a special program to refresh this discipline. The Hughes-Petersen lab received one of the first of these grants (called PEET grants) and while completing five projects, also graduated four Ph.D.s. With this track record, the lab received another PEET grant in 2000, under which another four Ph.D. students will graduate. "Students receive training in all aspects of systematic mycology from morphology to DNA sequencing and from herbarium management to botanical nomenclature," Hughes said. Usually students will work on a specific genus, determining its relationship to other genera and the relationships of species within the genus.

These research projects, starting as they do with organisms in nature, require fresh material from all over the geographic range of the mushrooms. This requires extensive travel to Europe, Russia, South and Central America, and Asia. Fruitbodies are collected, and their spores are germinated to produce the cultures needed for mating studies. Likewise, DNA is extracted from the mushrooms themselves or from their cultures. **Dr. Juan Luis Mata** is a post-doctoral participant in the latest studies and brings his particular expertise on fungi (the genus *Gymnopus*) now under investigation.

Several of the studies have involved fungi of commercial importance. The first was a study of the Jack-O'Lantern mushrooms (they glow in the dark and are bright orange). There is promising research which shows that compounds produced by these fungi are efficacious against a wide range of tumors. Another group of interest has been the genus *Flammulina*, sold in supermarkets under the name "enoki-take". UT has the largest collection of strains of this group in the world and is collaborating with researchers in Armenia, Russia, and Asia to circumscribe this genus. Another group has been *Pleurotus*, the "oyster mushrooms," an edible mushroom and also the source of lovastatin, a cholesterol regulator. The latest group has been the genus *Lentinellus*, known to produce insect repellents and other interesting compounds.

But such commercial adventures are not the center of these studies. Species

boundaries are defined using the methods mentioned above, and once defined; species distributions are examined and compared with distributions in other genera. "We have found a number of interesting patterns that suggest fungal gene flow occurred via the Bering land bridge between Russia and Alaska during periods when land was exposed," Hughes said. "We also have genetic evidence that during the last glacial maximum, fungi and their plant hosts were pushed south into refugia in present-day Mexico, Central America and the southern United States. With glacial retreat, fungi moved north from these refugia, leaving behind relict populations. The Great Smoky Mountains became a center of biodiversity, harboring unique species and hybrids derived from previously isolated populations and relic populations at higher altitudes."

The mycology group maintains an extensive collection of fungal cultures. Collected from around the world, these cultures represent an important research resource and are shared with other mycologists. Parts of the collection are, and have been used by drug companies and by NIH to search for natural products and new drugs. The culture collection contains about 5,000 dikaryon cultures and 100,000 monokaryon cultures, stored in test tubes and under water.

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Botany's Dynamic Duo

To work together for 17 years is one thing; to do it in the same office day in and day out is something else. **Eileen Coltharp** and **Eunice Turner** have been working together since 1986 and have seen many faculty and students come through the door of 437 Hesler Biology Buiiding.

Eileen Coltharp and Eunice Turner

Eileen has lived her entire life in nearby Andersonville. She commutes in every day to UT as she has since 1983. Her husband, **Tony**, commutes to Oak Ridge where he works as a traffic signal technician. She has two daughters and two granddaughters ages 11 and five.

Beyond the usual dance recitals and soccer matches she is expected to attend, Eileen has an interest in street rods. She and her husband show a 1948 Chevy, a 1936 Dodge truck and a 1939 Pontiac sedan in national street rod events. Her casual interest in cars has turned into a part-time job as a writer for the national magazine *Southern Rodder*. She writes columns on women who are interested in the hobby and on various regional meets.

Eileen is a Program Resource Specialist. Her main duties are payroll, travel, textbook orders, budget issues, and she helps the graduate students with their needs. She is also involved in the yearly Wildflower Pilgrimage.

Eunice is from Tazewell, Virginia. She has a degree in teaching from Radford University in Blacksburg and moved to Tennessee to pursue her dream of teaching math.

While she waited for a position to open in a local school, she took a temporary position in Botany in 1986. The temporary soon came off her title and she settled into her position as Principle Secretary.

She has two sons and a daughter. One of her sons is a songwriter in Nashville and the other is at Duke University pursuing his Ph.D. in computer science. After her sons moved out, Eunice provided a home for several foster children. Three years ago she said, "I saw my chance to get a daughter." Her now adopted daughter attends Whittle Springs Middle School.

Eunice's main duties are word processing, bi-weekly payroll, typing exams, and providing information for the time tables. She also typesets the southeastern information for the journal of the Association for Southern Biologists.

Department Head, **Dr. Ed Schilling** said, "Eileen and Eunice have been great to work with - they are not only extremely competent and knowledgable, but they also have a spirit of helpfulness that make it a joy to come into the Botany office."

While there is some crossover in duties between Eileen and Eunice, they work as a team to provide the support needed to help Botany run smoothly.

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DIRECTOR, *from page 3*

fiscal year; we shall await the legislature's decision.

This issue of *In Vivo* will take you through some of the exciting research programs housed within the Department of Botany. In addition, two of Botany's key staff, **Eileen Coltharp** and **Eunice Turner**, the heart of the Botany Office, are featured.

Despite Botany's dynamic state they have found themselves among a number of programs and departments listed for review by a group known as the Review and Reduction Task Force.

If the department is dissolved, one possibility is that its functions encompassing teaching, research and outreach will be redistributed among the remaining Divisional structures, Ecology and Evolutionary Biology, Biochemistry, Cellular and Molecular Biology and Microbiology.

The Task Force will most likely review Botany within the next three to five months. As you might imagine, there are many pros and cons to such reorganization. I will keep you posted as to the direction of events as they unfold with respect to the future of Botany at UTK.

Again, take a bit of time to enjoy the holiday season. See you soon.

Peace
Otto

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FUNGI, *from page 5*

The mycology web site (**http://fp.bio.utk.edu/mycology**) contains a number of tutorials including an extensive tutorial on nomenclature, techniques used in research and tutorials on the genera *Flammulina* and *Pleurotus*, both important edible and medicinal genera. A section on Tennessee fungi has been added, and although still very small, might contain a clue to what's growing on local mulch or in the garden. "We'll continue to add to this as we find interesting material," Petersen said.

Using classical training in mushroom identification, Petersen and his students are often asked to examine mushrooms by the poison control center in Memphis, one of the local hospitals or a veterinary clinic. Often a child or pet has eaten or chewed part of a mushroom and identifications have to be made on the basis of a small, well-mouthed fragment. Treatment decisions are made on the basis of these identifications. The mycology group also receives requests for information about mold problems in buildings and fungi involved in plant disease.

UT has one of the larger collections of dried fungi in the country, now at about 60,000 specimens. Over the past two years, and with the help of **Dr. Victor Ma** and his son, **John**, the fungal herbarium has been made electronically accessible with over 15,000 records databased (**http://enn.bio.utk.edu/fungus/fungus.html**). The interface allows browsing or searching by genus and by geographical location.

The Fungal Herbarium houses about 800 type specimens, which are the voucher specimens for new species. Also available is a list of fungi of the Great Smoky Mountains National Park, now the site of the All Taxa Biodiversity Inventory (ATBI). "Future plans for this include bringing the rest of the herbarium on-line so that records are available for taxonomic and ecological studies. We also have plans to add photographs of the collections, starting with the type specimens," Hughes said.

In March, the mycology group will sponsor Deep Hyphae meetings, a NSF-sponsored research coordination network involved in searching for the evolutionary roots of fungi using DNA sequence comparisons. Some 70-80 mycologists are expected to attend the two-day meeting to discuss future research goals for the mycological community and to exchange information on current research projects.

The mycology group will also sponsor a "mycoblitz" in July for the Great Smoky Mountains National Park in collaboration with the Mycological Society of America and mycologists at Duke University. Mycologists from many different specialties will collect in the Smokies together over a three-day period to develop a "snapshot" of fungi growing at that time. These data will contribute towards a survey of all macrofungi in the Park as part of an NSF-funded, four-year fungal ATBI study headed by Drs. Hughes and Petersen.

"The future for our kind of research is bright," Petersen said. "There is a demand for the classically trained persons, especially if they also have molecular training in their background. We see our own collaborative work continuing - there are a lot of mushrooms waiting for our examination."

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A Thank you to our Donors:

Karen Baker-Curtis, DDS
Hendersonville, Tenn.

Donna M. Fields
Memphis, Tenn.
In honor of **Dr. Fred Norris**

R. Dale Thomas, Ph.D.
Seymour, Tenn.

Alumni News

Ernest Shipe, Jr. received his Bachelor's degree in 1943 and his Master's in 1948. He is now retired from the Tennessee Department of Health where he served as a branch laboratory director.

R. Dale Thomas, Ph.D. received his doctoral degree in 1966 from Botany. He retired earlier this year to Seymour, Tenn. after teaching Botany and directing the Herbarium at the University of Louisiana Monroe for 37 years. He said, "**Dr. Patricia Cox** was a master's student of mine." He also said that during his career he collected more plant specimens than anyone else in the history of Botany at over 173,000.

Donna M. Fields graduated in 1970 and is now an attorney in Memphis, Tenn.

Charles Stanfill, Jr. graduated with a degree in Microbiology in 1978. Since graduation Chuck has worked as a Forensic Special Agent at the TBI and NCSBI crime laboratories. Those led to Special Agent field investigative careers at the NCSBI and with MasterCard / Visa. While serving as Safety Risk manager and Safety Consultant with the NCDOT he utilized both his education from UT and his prior experience and continues to do so today as the Safety Director at NC DENR in Smithfield, North Carolina. He is also the UT Alumni Chapter President for the Triangle Chapter of North Carolina.

Karen Baker-Curtis, DDS graduated in 1991 and is now a general dentist with a solo practice in Nashville. She is married to **T.P. Curtis III** and has two sons, **Porter** and **Steven**.

Robert Reeder received his degree in Entomology and Plant Pathology in 1996. He was recently hired as Microbiology Lab Supervisor of Colgate-Palmolive Company in Jeffersonville, Indiana.

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IN VIVO
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Focus on Division of Biology Websites:

By D.C. White, Ph.D.

Like the systems we study, the Center for Biomarker Analysis (CBA) is a complex consortium of scientific talents including analytical chemists, molecular biologists and microbial ecologists. CBA is devoted to incorporating the powerful tools of each of these professions to solve pressing microbial ecological problems.

The CBA pioneered the use of signature lipid biomarker research and continues to use this technology today. This is now correlated to analysis of genes DNA that both provide insight into phylogenetic relationships to the rest of biology, but to define functional genes. Our new website is designed to be an easy to use resource to the cross-scientific community we serve. Highlights include a completely searchable knowledge base including information on over 500 published papers, abstracts, slides, presentations and animation's describing our work which are available for download and use at **http://cba.bio.utk.edu**.