

# IN VIVO

Newsletter of the University of Tennessee Division of Biology

VOLUME 1, NUMBER 2

JUNE - JULY 2001

## The scenic route to professorship

### Dr. Pamela Long Claus

**Small**, a new associate professor in the department of Microbiology, did not follow a traditional path to becoming a microbiologist. She started her journey as a married teenager, soon with four children, following her husband's career as an anthropologist. After going to school part-time for 14 years, she received her B.A. in anthropology. During this time she spent four years in India where she volunteered as a paramedic, while doing research in medical anthropology. There she developed an interest in infectious diseases.

After returning from India, she

found herself as a single mother needing to support her family. She went back to school in California to become a medical technologist. However, with the encouragement and support of her sister, she instead attended graduate school at Stanford at the age of 37. At Stanford she studied bacterial pathogenesis under the "Father of molecular pathogenesis," **Dr. Stanley Falkow**.

She became an assistant professor at Middlebury College in Vermont. While on sabbatical, the National Institutes of Health (NIH) offered her the opportunity to concentrate on research full time as head of a

new cellular microbiology unit. With a new husband in tow, she moved to the National Institute of Allergy and Infectious Disease's (NIAID) Rocky Mountain Laboratories in



**Pam Small, Terri Alford, Brian Ranger, Alexa Daniel, Sarojini Adusumilli**

Hamilton, Montana where she studied cell biology and intracellular pathogens such as *Salmonella* and *Shigella*.

Small broke new ground as the first female to head a lab for NIAID. At the time, the site did not have any female senior scientists and very few female post-doctoral fellows.

Small soon began work on a

*Continued on page 2*

### From the Director John Koontz, Ph.D.



It is the end of the academic year. We have recently completed the budgetary process for next year. Graduation was last Friday and

today the campus is comparatively quiet. Today is one of those rare days when you feel like you have the time to delete a lot of old e-mail, clear up some of the clutter from your desk and spend time thinking.

I sometimes comment to my colleagues that it frequently seems as though we are so busy that we rarely take the time to reflect on what is happening around us: somewhat of a contradiction at an institution of higher learning.

The budget process gave substance to the two most important issues facing the Division: recruiting outstanding new faculty and new graduate students. Because of faculty retirements, each of the departments in the Division has vacant faculty positions to fill.

This is an exciting prospect. It offers the opportunity to build for the future, to shape and to position us for the longer term. This issue of the newsletter highlights this point in presenting vignettes of new faculty in Microbiology. In future issues we will highlight other new faculty and feature faculty who are retiring.

There are several factors to

*Continued on page 2*

### Table of Contents

From the Director .....	1
Spotlight on Microbiology .....	1
Department News .....	3
New Microbiology Faculty .....	4
Focus on Staff .....	6
Research Awards .....	6
Division News .....	7

### Small, Continued from page 1

new program for the study of the mycobacterial pathogens such as those that cause leprosy and tuberculosis. Eventually she came to study the pathogen *Mycobacterium ulcerans*, which causes Buruli ulcer, a disease that is rapidly increasing in West Africa.

While at the Rocky Mountain Lab, she missed the contact with students she had had at Middlebury College, so last year she made a visit to UT. She found that the Microbiology department was all male and had been for its entire 87 years. Small said, "I was a little apprehensive at first, I didn't want it (gender) to be an issue." But after meeting the faculty, she said, "I knew that I was hired based on my scientific merits."

She likes the city of Knoxville, the caliber of students and her colleagues in the Microbiology department. She also enjoys the opportunities for broad collaboration between the various types of microbiologists on campus with access to the faculty of Chemistry, Veterinary Science, Food Science and Environmental Microbiology. Small also has a part-time appointment with the College of Veterinary Medicine.

She has three graduate students and a technician to help with her new five-year \$1.4 million NIH grant. Next year, Small will begin teaching Medical Microbiology plus participate in a seminar class.

Small and her husband prefer a rural setting and hope to move out of the city eventually. They also enjoy playing a variety of stringed instruments in bands that feature folk music, western swing and jazz.


### Small's World

Pamela Small conducts her research on a little known disease called Buruli ulcer. It is found in 25 countries, but she focuses on West

Africa, specifically in the countries of Ghana, Benin, Cote d'Ivoire and Togo.

The bacterium *Mycobacterium ulcerans* invades the body by unknown means and destroys the subcutaneous fat layer. The skin above the infected areas eventually dies and sloughs off. A single ulcer can include 20% of a patient's skin surface. In some cases the disease can lead to auto-amputation of a leg or arm.

It is not known how Buruli ulcer enters the body and there is no cure, aside from surgery. Physicians can only surgically remove the infected area and use skin grafts to cover the extensive wounds. Small and other scientists believe the source of Buruli ulcer can be traced to stagnant water and its aquatic inhabitants.

Small works with the World Health Organization taskforce to encourage the local people to seek help in the early stages of the disease. Although Buruli ulcer is not fatal, a tremendous physical as well as economic hardship is put on the victims and their families. 

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### IN VIVO

An Alumni newsletter published by the Division of Biology

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### Director, Continued from page 1

consider in recruiting the best people to fill these positions, however the main consideration is what the research emphasis should be.

Do we want to move into a new research area or do we want to build a greater critical mass within an existing area of strength within the departments? What are the research funding trends in life sciences today? How do these fit with our existing strengths? How can we position ourselves to be leaders in these areas?

We cannot contribute to the initiative of Dr. Gilley to move UT into the top ranks of public research institutions if we do not factor this into our deliberations.

Equally important is the amount of start-up money necessary to recruit each new faculty member. The competition for new faculty in the biological sciences and the expectations placed on them is such that the average new faculty recruit will require more than one quarter of a million dollars to establish their research program.

Satisfying this consideration is beyond our control since no individual department has the discretionary resources to cover this expense. The university faces this challenge in that the same opportunities are presenting themselves to many other departments where substantial start-up packages are necessary such as physics and chemistry. However, we must meet this challenge if we are to be a top research institution.

Recruiting excellent graduate students is the second important issue we face. Perhaps the single most critical, limiting factor in this process is the stipend that we can offer to prospective students. Stipends within the Division vary between departments because some departments have collapsed the number of positions in order increase the amount. However, our peer institutions still offer stipends that are \$3,000-\$4,000 more than

*Continued on page 7*

## A Word from the Head



When I assumed the headship of this department there was a fairly clear demarcation of

faculty interests between biomedical and environmental/ecology aspects of microbiology. Five years and three new faculty later, I am confused.

It seems our faculty have forgotten that there are defined

boundaries separating the traditional fields of the discipline. Faculty hired as environmental/ecology types

are becoming involved in biomedical issues while pathogenesis types are delving into environmental issues. Moreover, the faculty are generating hybrid students conversant and capable in the blended discipline.

As a biomedical type, I never imagined that I would be involved in efforts to understand the complexity of life in natural environments, much less in efforts aimed at modifying the negative impacts of progress and abuse.

Now much of my time is spent being educated in the influences of iron and viruses on productivity in marine environments, the quest for pathogens in altered environments, and the rapidly developing fields of genomics, nanoscience and biotechnology.

While I doubt I will ever take a water sample from a rice paddy in Ghana, from the “Peruvian Up Welling”, or from somewhere in the Antarctic, I truly enjoy facilitating and promoting the effort.

More significantly, I am proud that this department is at the front of the evolving discipline. Changes in faculty interests and in the field add additional challenges in the recruitment of graduate students with backgrounds and potential to succeed.

Our graduate class set for next Fall continues our success in recruiting versatile students. Eleven students were offered positions, and 10 have indicated they will begin the program.


**“As a biomedical type, I never imagined that I would be involved in efforts to understand the complexity of life in natural environments”**

This truly international class includes American, Chinese,

French, Indian, and Turkish students, and, with an average GRE score of 1900, we expect this class to continue the outstanding tradition of our past and present students.

Undergraduate enrollment in our classes remains high, and this Fall the faculty will reevaluate our curriculum to determine if we continue to meet the instructional needs of our majors. I am happy to report that a large number of these students are taking advantage of research opportunities in faculty laboratories.

Thanks to the generosity of our alumni and friends, we will be able this coming year to offer continuing rather than sporadic scholarships to promote undergraduate research.

Consequently, our benefactors are the significant difference in the preparation of our new health professionals, scientists, and teachers. On their behalf, we thank you! 

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## Providing tools for bacterial study

Following a winding path to Knoxville, **Dr. Ena Urbach**, a new assistant professor of Microbiology, started her life in New York City and grew up in northern New Jersey. In New Haven, Connecticut, she received her B.S. from Yale in Molecular Biophysics and Biochemistry. She then moved to Boston to begin her doctoral program at the Massachusetts Institute of Technology, thinking she would focus on cancer biology.

Halfway through the program she took some time off to re-evaluate her career goals. "I was reading about molecular and microbial ecology, which at the time was a pretty young field. I thought that this would be the perfect thing for me to do." Urbach said, "Because I'm more interested in the larger picture of biogeochemical systems on the earth."

She returned to MIT and received an interdepartmental doctorate in 1995 from the departments of Biology and Civil and Environmental Engineering. She said, "I think I'm the only one ever" to choose such

its ecology and genetic variations. For her postdoctoral research, she moved to Oregon State University in Corvallis. There her research involved an interdisciplinary study of the bacterial ecology of Crater Lake in Oregon, in collaboration with the Crater Lake Long-Term Monitoring Study.

This group has been in existence for 16 years, but the scientists involved had not yet studied the bacteria of the lake. Urbach said, "I was able to relate the pattern and distribution of different bacterial species that we


new method for identifying active bacteria in a population and she will use her current NSF grant to continue its development. This molecular tool will aid her study of the physiological, genomic and phylogenetic characteristics of environmentally important microorganisms.

So far she has studied bacterial samples from the Bermuda Triangle, the Gulf Stream, and the Juan de Fuca Ridge fault zone. "The work that I want to do, now that I am at UT, is to use molecular methods to look at the biochemical potential of currently unculturable, but ecologically important organisms in the ocean and lakes,"

Urbach said. "I am hoping to use the flow cytometer again, this time in combination with probes that will distinguish relatively narrow genotypes within these species."

The goal is to apply what is learned from the study of bacteria that can be grown in laboratory cultures to species that are unculturable.

She explains, "It's very important for us to understand the cycling of chemicals through the environment, especially the oceans, which are an important habitat in terms of understanding global carbon cycles. We would like to know in greater detail what this chemistry is. And the organisms that break down most of the carbon compounds in the oceans are likely to be these bacteria that are difficult to culture."

With the information gathered from her research, Urbach hopes she can "begin to build a model of the biogeochemistry of the ocean." 

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*Urbach enjoying a sunset on the Sargasso Sea*

saw, to variables that the other scientists had observed."

The American Society of Limnology and Oceanography on-line featured the collaborative article in their May issue ([www.aslo.org](http://www.aslo.org)). Although she plans to remain active in the Crater Lake study, she is currently following another vein of research involving aquatic bacteria.

The primary focus of her current research is not a particular bacterium; therefore she chooses organisms that are numerically abundant. Urbach has invented a

**"The work that I want to do, now that I am at UT, is to use molecular methods to look at the biochemical potential of currently unculturable, but ecologically important organisms"**

an unusual combination.

Using a flow cytometer for her thesis research, she was able to examine natural populations of the marine cyanobacterium *Prochlorococcus marinus* to study

## Working for cleaner water

**Dr. Steven Wilhelm**, an assistant professor in Microbiology, is on the trail of the environmental cues that control the potent hepatotoxin, microcystin, which can be found in lakes and drinking water reservoirs around the world.

Wilhelm's Aquatic Microbial Ecology Research Laboratory works closely with the Microbial Ecology of the Lake Erie Ecosystem (MELEE) Network to study the cyanobacterium *Microcystis aeruginosa* to determine how changes in its environment affect the production of microcystin.

Along with Professor **Dr. Gary Stacey** of Microbiology, Wilhelm is working to develop molecular diagnostic tools to use in the field to study a five-year recurring bloom of Microcystin, which can cause serious side effects in animals and humans. The need for sophisticated equipment in the field is essential.

Wilhelm said, "every time we collect a sample, we run the major risk of contamination. So if we can take a look at a sample quickly and cleanly and examine its DNA and RNA, to see which genes are being turned on and off, we can make judgments (in the field) as to what is happening."

A native of Ontario, Canada, Wilhelm is able to collaborate with colleagues in Canada and the U.S. by concentrating his efforts on Lake Erie. With the Great Lakes holding 20 percent of the earth's drinking water, Wilhelm feels Lake Erie is an excellent laboratory.

The goals of the MELEE Network are to develop a better understanding of the microbial communities in Lake Erie. One specific goal is to develop a genome-based approach to studying how cells respond to changes in the environment and to develop specific probing approaches for looking at toxin production. Ultimately, Wilhelm hopes their work will help provide cleaner drinking water by developing a test for microcystin to be used

in water treatment plants.

Wilhelm's work at UT is spread over five National Science

Foundation (NSF) grants, so the Microcystin research is only one specific example of his work. In the broader sense, he is trying to understand what effect the environment has on microorganisms that are found in the earth's waters.

From the Bermuda Triangle to the Bering Sea, Wilhelm's lab studies the effect of viruses on the bacteria and algae and the role that the availability of iron plays in regulating production in these systems.

First, most viruses in natural systems kill bacteria and algae to maintain their population. Since algae are responsible for 50 percent of the earth's photosynthesis, it is important to determine how viruses "short-circuit" the flux of carbon through these systems.

Second, there appears to be




*Wilhelm, with marine technician Paul Moyet in the foreground, retrieving a CTD sampling rosette in the Sargasso Sea (Bermuda Triangle)*

**Ultimately, Wilhelm hopes their work will help provide cleaner drinking water by developing a test for microcystin to be used in water treatment plants.**

a link between iron assimilation and the release of toxins such as microcystin. For example, the cyanobacterium *Microcystis aeruginosa* responds to its environment as the bioavailability of iron in the water changes, and this directly affects the production of microcystin. Masters student, **Shannon Pedigo** is currently working to confirm or refute these findings.

In short, Wilhelm's research spans the waters of the earth to understand what creates balance and imbalance in a system.

When he is not out on a boat conducting research, Wilhelm teaches Microbial Ecology and Microbial Physiology to graduate students. He also team-teaches Introduction to Oceanography with Jackie Grebmeier of the department of Ecology and Evolutionary Biology. 

[www.bio.utk.edu/microbio/wilhelmlab/](http://www.bio.utk.edu/microbio/wilhelmlab/)

## Stanley Zane Guffey: Instructor Extraordinaire



“A lot of people don’t make a difference because they don’t care about the area they live in. I care about this area, so I think I should stay around here in order to make changes

happen.” **Dr. Stan Guffey** knows his place. Not only has he made his home in the Appalachians, his heart lives here also.

Stan wants to make changes through research that will improve conservation efforts in the Appalachians, but he also wants changes in the way biology is taught at UT. And he likes a challenge. He is one of the brave few who actually enjoy teaching general biology to non-majors. He feels that since it is likely the “only science they are going to get” it should be presented in an interesting and challenging manner.

Sophomore, **Reem**

**Abdelrazek** is taking Biology 102 for non-majors and appreciates Stan’s teaching style as well as his use of technology in the classroom.

“I love Dr. Guffey,” Abdelrazek said, “Even though he has 400 students in a class, he takes the time to help me individually. He posts his class notes on his website and uses Power Point presentations to teach. Even in a class that size, he uses side stories for illustrations and asks for questions.”

As an instructor associated with the department of Ecology and Evolutionary Biology (EEB), Stan also teaches Introductory Biology for majors, Conservation Biology to seniors and First Year Studies classes.


He is a member of the Environmental Studies Program Curriculum Committee, the UT Appalachian Studies Major Planning Committee and has taught biology teachers during the summer at the UT Academy for Teachers of Science and Math.

Along with his passion to teach biology, Stan focuses on his love of trout. He enjoys the study of native Southern Appalachian brook trout in the neighboring Great Smoky Mountains National Park. He feels the study of brook trout in the Smokies is a model system, which affords the study of 1) a native species reaching the limit of its range, 2) the effects of land use on native species and 3) the effects of intrusion by non-native species.

**Dr. Gary McCracken**, professor of EEB has worked with Stan on the brook trout project. McCracken said, “Stan’s work focuses on the really interesting basic biological question of meta-population structure and how this changes through time because of man’s activities. The brook trout are the only salmonid species native to eastern North America.”

McCracken feels that this work is of local and regional significance because the number one priority is to help recover this rare species. Because of his

research in this ideal environment, Stan has been able to share his findings with like-minded organizations such as the Southeastern Ecological and Population Genetics Group, the Association of Southeastern Biologists and the Southeastern Division of the American Fisheries Society.

By laboring under the dual passions of teaching and research, Stan strives to make a difference in the mountains he calls home. 

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## Faculty Research Awards

The Science Alliance awards were established in 1984 to increase and enhance research. This year 42 UT faculty received an award, a third of them were from the Division of Biology.

**Jeffery Becker** – Biochemistry and Cellular and Molecular Biology / Microbiology

**Gordon Burghardt** – Ecology and Evolutionary Biology / Psychology

**Sergey Gavrilets** – Ecology and Evolutionary Biology

**Jacqueline Grebmeier** - Ecology and Evolutionary Biology

**Louis Gross** - Ecology and Evolutionary Biology

**Karen Hughes** – Botany

**Ronald Petersen** – Botany

**Cynthia Peterson** – Biochemistry and Cellular and Molecular Biology

**Massimo Pigliucci** - Ecology and Evolutionary Biology / Botany

**Daniel Roberts** - Biochemistry and Cellular and Molecular Biology

**Barry Rouse** – Microbiology

**Gary Stacey** – Microbiology / Ecology and Evolutionary Biology

**Albrecht von Arnim** – Botany

**Jake Weltzin** - Ecology and Evolutionary Biology

**Habib Zaghouani** – Microbiology

For more details, go to:

<http://research.utk/scialli/>

The following individuals were selected by a panel of faculty as the recipients of this year’s **Graduate Student Science Alliance Awards**:

Shilpa Deshpande  
Tadashi Fukami  
Chitra Subramanian  
Juan Mata  
Carole Dabney  
Shannon Eaker  
Dasharath Lohar

## Alumni News:

**Ben Benson, M.D.** received his undergraduate degree from the former Zoology Department in 1960 and is now practicing in Ft. Worth, Texas.

**Tom Dockendorff, Ph.D.** graduated from Microbiology in 1993. He is now an Assistant Professor of Zoology at Miami University in Oxford, Ohio. He presented a lecture for the Biochemistry and Cellular and Molecular Biology department on campus in May titled "A Drosophila model to study the Fragile X mental retardation protein."

**Russell Glass** received his undergraduate degree from the former Organismal and Systems Biology track in 1996. He is currently enrolled at the University of Memphis School of Law, where he is preparing to practice Environmental Law.

**Matt Breeding** received his undergraduate degree from Microbiology in 2000. He is currently enrolled in the Medical Technology program at The University of Tennessee Medical Center in Knoxville, Tenn. and plans to graduate in December.

**Rusty Smith** received his undergraduate degree from the former Biology department in 1995. He received his Masters degree from the UT department of Environmental Engineering in 2000. He now works for the TVA Regional Natural Heritage Program in Norris, Tenn. He maintains a database of known occurrences of rare plants and animal species found in the seven state region and produces environmental reviews for projects and services provided by TVA.

## Spring Seminars:

### Biochemistry and Cellular and Molecular Biology

*These BCMB seminars were part of a semester-long series focusing on neurogenomics:*

"Scents and scents ability: Development and function of the olfactory system in the zebrafish *Danio rerio*" – **Kathleen Whitlock** of Cornell University, February 28, 2001

"Genetic analysis of NSF function in Drosophila" – **Leo Pallanck** of the University of Washington, March 28, 2001

"Want signaling in asymmetric neuroblast division and neural migration" – **Gian Garriga** of the University of California, April 18, 2001

### Botany

"Roles of human population, area, time and native diversity in raising non-native species diversity" – **Mike McKinney** of the UT Department of Geology, March 26, 2001

"The roles of selection, constraint, and correlation in floral evolution: a case study" – **Jeff Conner** of Michigan State University, April 16, 2001

"Modulation of ammonium assimilation in transgenic legumes during the symbiosis with Rhizobium" – **Georgina Hernandez** of Centro de Investigación sobre Fijación de Nitrógeno – UNAM, April 30, 2001 (co-sponsored by Microbiology)

### Ecology and Evolutionary Biology

"Dynamical models of heterogeneous populations and communities" – **Georgy Karev** of the Georgia Institute of Technology, March 2, 2001

"The ecosystem consequences of declining biodiversity: A new ecological paradigm" – **Shahid Naem** of the University of Washington, Seattle, March 9, 2001

### Microbiology

"T-cell control of viruses" – **Peter Doherty**, of St. Jude Children's Research Hospital in Memphis, February 12, 2001

"Bacterial infection, colitis, and tumorigenesis" – **David Schauer** of the Massachusetts Institute of Technology, March 26, 2001


"Invasive hyphal growth of *Candida albicans* promoted by interactions with surrounding matrix" – **Carol Kumamoto** of Tufts University, May 7, 2001

### Director, Continued from page 2

ours. At the same time, the NIH is pledging to raise graduate stipends from the current \$16,500 to \$25,000 (Science, March 30, 2001). As stated in the article, "...most universities tie their pay scales..." to these awards. This will be almost \$10,000 more than the best stipends offered in the departments within the Division.

While this will also be a challenge to other academic institutions, many of those, including our peers, will start from a higher base in striving to achieve that new standard. We depend almost exclusively on the state for support in recruiting new faculty and new graduate students.

However, I am asking for your help particularly in the area of graduate student support. You can help by donating to a fund that is used to upgrade graduate stipends. If you choose, you may designate your gift toward a specific department. An employers matching gift program can double or triple your contribution.

We must successfully address these two issues if we are to achieve our maximum potential. You can help contribute to the solution. You will learn of our solutions as we make progress in these areas. 

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VOLUME 1, NUMBER 2

JUNE - JULY 2001

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Please contact us if:

- We have double mailed
- We have an incorrect address
- You have personal or career-oriented news
- There is a particular subject or faculty member you would like to learn more about

## Pique the curiosity of a teenager

We are currently designing brochures to educate high-school students about the interesting careers available to Biology graduates. If yours is a career that you feel might pique the curiosity of a teenager, please use the enclosed postage-paid envelope for corespondence, or contact Laura Maples at [Imaples@utk.edu](mailto:Imaples@utk.edu).