Written By Robin Roenker

University Research Professors

Subbarao Bondada: Inhibiting Lymphoma Growth

Each year, more than 60,000 new cases of lymphoma, a cancer of the white blood cells, are diagnosed in the United States. Many lymphomas are due to a runaway proliferation of the body's B-lymphocytes, cells that produce antibodies against infectious disease. As the manufacturers of antibodies, B-lymphocytes are usually useful and good; their overproduction, however, can lead to cancer.

Hindering B-cell lymphoma growth is the goal of Subbarao Bondada's research at the UK Sanders-Brown Center on Aging. Currently, his lab is focusing on two aspects of lymphoma growth regulation: a transcription factor called Early Growth Response Gene 1 (EGR-1) and an enzyme known as c-Jun N-terminal Kinase (JNK). Transcription has to do with making an RNA copy of a DNA segment of a gene.

Bondada's earlier research showed that "if you inhibit the expression of EGR-1, you can inhibit the growth of B-cells." Now, his research team will try to determine whether inhibiting the expression of EGR-1 can prevent some lymphomas from developing altogether. The team will also work to better understand the role of JNK, which is active in some lymphoma cells but inactive in most normal B-cells.

"Very few people are working with EGR-1 in the context of lymphoma, and as far as I know, no one else has looked at JNK expression and how that could be related to lymphoma growth," says Bondada, a professor in UK's microbiology, immunology, and molecular genetics department. In addition to helping fund Bondada's research, the University Research Professorship allowed Bondada to add a postdoctoral assistant to his research team.

"The biggest challenge we face is to translate our findings from tissue culture about the importance of JNK for lymphoma growth to animal models and then to human systems. It's difficult because the same kinases that support the lymphoma growth may also be important for normal function of other cell types in the body."

Bruce Webb: Linking Insects and Illness

As a researcher interested in the interaction between microbes and insects, Bruce Webb didn't expect to find himself working on Mare Reproductive Loss Syndrome (MRLS). But since the 2001 MRLS outbreak, which resulted in thousands of equine abortions across Kentucky and neighboring states, Webb's lab has been immersed in studying the eastern tent caterpillar's role in the disease.

The caterpillars are "absolutely part of the cause," says Webb, a professor of entomology who came to UK in 1995. But he believes their link to MRLS has nothing to do with cyanide from wild cherry trees, as originally proposed.

Webb's hypothesis, developed with Karen McDowell (veterinary science), Neil Williams and Mike Donahue (UK Livestock Disease Diagnostic Center), and Kyle Newman (Venture Laboratories in Lexington), is that ingestion of caterpillars by horses causes lesions in a horse's mouth and intestines, allowing normal bacteria from these sites to enter the horse's bloodstream. The bacteria then invade fetal tissues and replicate to produce infections, which ultimately cause abortion.

Since 1988, Webb has also investigated links between insects and viral infections through his work with polydnaviruses, viruses that cause an AIDS-like suppression of insect immunity. "Insects' ability to transmit disease is dependent on their immune system," Webb explains. "So, the better our understanding of insect immune systems, the better able we are to prevent the transmission of disease by insects."

Webb plans to use his University Research Professorship to continue to study the diverse interactions between insects and microbes.

PROFESSORS 2004-2005

Enrico Mario Santí: Octavio Paz's Intellect and Poetry

Miami Herald

Enrico Mario Santí hopes to finalize his biography of Mexican poet and essayist Octavio Paz within the next year. It's a special project for Santi, since he and Paz, winner of the 1990 Nobel Prize in Literature, were friends.

Santí first began the biography in 1983, but he set aside the project when Paz asked him to work instead on a series of critical editions of Paz's work.

"We became very close," says Santí, who came to UK as the first William T. Bryan Endowed Chair in Hispanic Studies in 2000. "Working on editions of Paz's poems and essays allowed me to learn much about the man and his work."

Paz "transformed poetry for the post-war reading public," Santí says. "His poems are at once rigid and sensual. They are intellectually stimulating and creative in their images." As an essayist, Paz was the "first to bring major movements such as existentialism and structuralism into Hispanic literature."

Even after his death in 1998, Paz remains a controversial figure in Mexico. His gradual rejection of communism and socialism, and decades-long campaign to democratize Mexico made him a lot of enemies, says Santí.

The University Research Professorship has allowed Santí to take a break from teaching to give full attention to completion of his manuscript, which he calls an "intellectual biography" of Paz: "My focus is on looking at the man in order to better understand his body of work, rather than the other way around."

The UK Board of Trustees first awarded University Research Professorships in 1977. The goal of these $35,000, one-year professorships is to enhance scholarly research and awareness of UK's research mission by recognizing outstanding faculty.

Peter D. Hislop: Modeling Conductivity

UK mathematics professor Peter Hislop is trying to answer a question that has perplexed mathematical physicists for decades: Why is electrical conductivity finite?

"Only a limited current is available in a socket," Hislop explains. "Infinite conductivity means that the electrons in a wire would be continuously accelerated without losing any energy, as if there was no friction. But this isn't the case."

In trying to find the answer to this question, Hislop draws on aspects of quantum mechanics and what is called the Schrödinger equation, which describes the interactions between electrons and atomic nuclei. This noninteracting, one-electron model of solids was first developed in the 1920s. Despite the model's merits, it has some "fundamental problems," says Hislop. In some cases, for example, the model predicts instances in which metals would demonstrate infinite conductivity, a phenomenon not observed in nature.

To address this problem, a new model with randomly distributed impurities and defects was introduced in the 1950s by Nobel Laureate P.W. Anderson. Focusing on a particular type of mathematical operator called "a random Schrödinger operator," Hislop's work aims to understand the fundamental properties of Anderson's model that will help to identify the "physical mechanisms responsible for the finite conductivity of metals observed every day," he says.

"My work is basically pure research—trying to understand why materials conduct electricity and how efficiently they do so. A better understanding of this could add to the design of better materials for power lines, for example." Hislop's research has been continuously supported by the National Science Foundation since he arrived at UK in 1989.

In addition to his research, he will use funding from the University Research Professorship to support a seminar speaker series and workshop at UK this year on random Schrödinger operators.