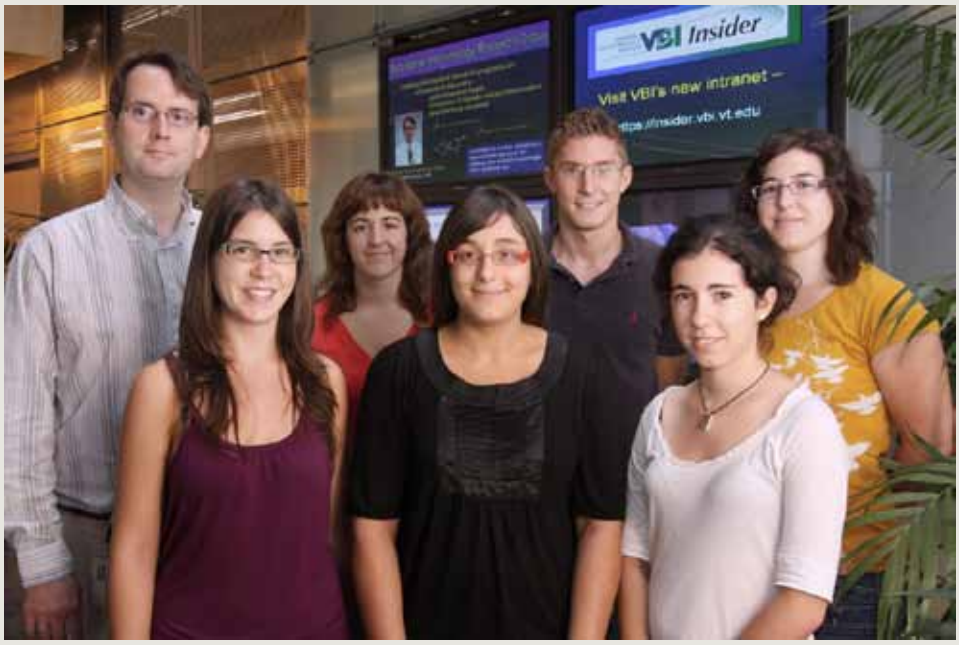
Volume 4. Number 3. Fall 2009 • Newsletter of the Virginia Bioinformatics Institute at Virginia Tech

e_Connections

VIRGINIA BIOINFORMATICS INSTITUTE AT VIRGINIA TECH VBI

FEATURE | TECHNOLOGY | IN THE NEWS | FEATURE



Left to right: Josep Bassaganya-Riera, Montse Climent, Mar Armengol, Teresa Salazar, Adrià Carbó, Graciela Lopez, and Cristina Vives

In This Issue

Undergraduates working at VBI hope to take their knowledge back to Spain

Six undergraduate students from the University of Vic in Catalonia, Spain spent the summer working with VBI Associate Professor Josep Bassaganya-Riera's Nutritional Immunology Research Group on three research projects. The work, which involves the use of a system's approach to develop novel therapies to combat chronic and infectious inflammatory diseases, will result in a scientific paper suitable for publication.

Mar Armengol, Adrià Carbó, Montse Climent, Graciela Lopez, Teresa Salazar, and Cristina Vives visited Blacksburg, Va., from the beginning of July through the end of September as part of the Undergraduate Research Program in Nutritional Immunology. This European Union-funded program, which is part of a four-year partnership between Bassaganya-Riera's research group at VBI and the University of Vic Department of Systems Biology, has provided the visiting students the opportunity to spend the summer at Virginia Tech doing research. The students are expected to put into practice a conceptual framework at the interface of nutrition, immunology, and systems biology by designing and conducting a research project, becoming familiar with state-of-the-art analytical immunology techniques used to address the working hypotheses, and completing research data management and analyses.

"I have never worked in a laboratory before," Lopez said. "For me, this has been my first working experience in a lab and I love it. I am learning a lot of new things and gaining confidence in a laboratory environment, which is something that cannot be done in the classroom."

In teams of two, the students worked on three specific research projects during their visit. Lopez and Salazar worked with Bassaganya-Riera on a project designed to identify novel interventions for the prevention of Inflammatory Bowel Disease (IBD) without side effects. Conjugated linoleic acid (CLA) has been shown to improve IBD through the activation of the peroxisome proliferator-activated receptor (PPAR) γ. PPARs are a group of nuclear receptor proteins that function as transcription factors regulating the expression of genes. The team investigated whether similar lipids, specifically conjugated triene fatty acids, could ameliorate IBD by suppressing inflammation through a PPAR γ-dependent mechanism.

According to Lopez, "To be able to not only work in a lab, but develop your own research project from the initial idea to writing a scientific paper, has been one of the greatest opportunities I could ever have."

Lopez's University of Vic classmate Carbó shares her sentiments. Carbó and Armengol worked on a project supervised by VBI Assistant Professor and group member Raquel Hontecillas involving immune response during influenza infection. This work also involved the function of PPARs, which play an essential role in the regulation of cell differentiation, development, metabolism, and tumorigenesis of higher organisms, as well as the regulation of some immune responses. The research focused on how PPAR δ modulates the immune response against influenza infection. Since earlier work has shown that PPAR δ regulates the migration of inflammatory cells, the students worked to elucidate the role of this molecule in the inflammatory response and neutrophil infiltration that occurs in the lungs of PPAR δ-deficient mice that have become infected with the flu virus.

"This experience has show us how to use different techniques in the lab and solve specific problems," said Carbó. "We now have a better idea of how to handle a research project, and we learned all of this as undergraduate students."

Climent and Vives also worked with Hontecillas to characterize several strains of tissue-specific PPAR γ null mice developed by the group. These mice represent valuable tools for understanding the mechanisms of action underlying inflammatory diseases and this work will set the stage for a wide range of mechanistic studies dissecting the role of PPARs in inflammatory diseases.

The students continue to work on scientific papers about the research, which is a requirement for completion of the program. They also plan on giving presentations about their visit to the United States to their classmates, and several of the students are considering returning to the U.S. for graduate school.

"Research here is at a different level," Carbó said while explaining why some of the students would want to return. "The U.S. is the leading nation in biotechnology research and we want to gain experience and bring that knowledge to Spain." ■

Distinguished computer scientist discusses performance challenges

> "This is the best opportunity computer science has to improve user productivity, application performance, and system integrity. We have to rethink how we solve the problem."
>
> - FRANCES ALLEN

Frances Allen visited the Virginia Tech campus on Friday, September 11, and shared her experiences and wisdom gained from a lengthy career devoted to high-performance computing. The 2006 recipient of the Association for Computing Machinery Turing Award, computer science's version of the Nobel Prize, and the first woman to be named an IBM Fellow, Allen presented the talk, "High Performance Computers and Compilers: A Personal Perspective," which chronicled her involvement in a number of high-profile projects at IBM and included a discussion on what she sees as the new performance challenge for the computer science field.

Allen joined IBM as a programmer in 1957 with the task of teaching researchers the computer language FORTRAN. With a specialty in compilers and program optimization for high-performance computers, Allen has played an integral role in the development of several programming languages that have advanced the computer science field. She was involved in IBM's Stretch-HARVEST project, which was a system designed for the National Security Agency in the early 1960s to make programming easier through the use of a compiler to generate code automatically from statements in the user's language. A compiler helps translate a program written in a high-level programming language into a lower-level language more easily executed by a computer. Allen developed an advanced code-breaking language called ALPHA for the Stretch-HARVEST project. She was also a founding member of the Parallel Translation Group (PTRAN) in the early 1980s. The PTRAN group was recognized as one of the top groups in the world for working with parallel computing. Her involvement in parallel processing, which gives computers the ability to run programs simultaneously on multiple processors, paved the way for current high-speed computing capabilities.

According to Allen, IBM cancelled the PTRAN project in the early 1990s, because the general consensus was that parallelism was no longer useful. Interestingly, she explained, parallel processing is now what is needed to help meet the new performance challenge for the field of computer science – technology that is hitting a performance limit. With the introduction of multi-core processors, which includes the integration of more processors on a single chip, Allen explained that the goal now is to allow both software and users to organize tasks in parallel.

"These are the computers that are needed to solve the 'grand-challenge' problems and these problems are not going to go away," she said. "Parallelism is going to become how we're going to solve the problem."

She told the audience that computer scientists must not forget the important goals of the field – user productivity and program performance.

"The old methods have taught us a lot, but we're in a new world," Allen said. "We have to find a way to manage data through these big systems in a very different way than we're doing now. This is the best opportunity computer science has to improve user productivity, application performance, and system integrity. We have to rethink how we solve the problem."

Allen received her bachelor's degree in education from Albany State Teacher's College, now known as the State University of New York at Albany, in the early 1950s. She earned a master's degree in mathematics at the University of Michigan and spent 45 years working at IBM Research. She is now an IBM Fellow Emerita, as well as a member of the National Academy of Engineering and the American Philosophical Society, and a Fellow of the American Academy of Arts and Sciences, Association for Computing Machinery, Institute of Electrical and Electronic Engineers (IEEE), and the Computer History Museum. Allen's talk was part of Virginia Tech's College of Engineering Department of Computer Science Distinguished Lecture Series for the 2009-10 academic year. ■

VBI in the News

VBI faculty involved in Algebraic Methods in Systems Biology and Statistics program

VBI Professor Reinhard Laubenbacher recently completed his year-long tenure as committee chair of the Statistical and Applied Mathematical Science Institute's (SAMSI) 2008-09 Program on Algebraic Methods in Systems Biology and Statistics. The program focused on the further development of the emerging research areas of algebraic biology and algebraic statistics and provided researchers working in algebra, algebraic geometry, discrete mathematics, and mathematical logic the opportunity to work with statisticians and biologists on fundamental advances in the development and application of algebraic methods to systems biology and statistics. Program activities included workshops to engage a broadly representative segment of the mathematical, statistical, and life sciences communities to determine research directions for working groups composed of SAMSI visitors, postdoctoral fellows, graduate students, and local faculty and scientists. In addition to Laubenbacher, who proposed and directed the program, VBI Professors Ina Hoeschele and Brett Tyler served on the program's organizing committee.

Virginia Tech Board of Visitors approve tenure for VBI faculty

Three VBI faculty members were officially granted tenure after the June 1 meeting of the Board of Visitors of Virginia Tech:

- **Vladimir Shulaev** was promoted to Professor with tenure, collegiate faculty in the Department of Horticulture.
- **Iuliana Lazar** was promoted to Associate Professor with tenure, collegiate faculty in the Department of Biological Sciences.
- **Christopher Lawrence**, Associate Professor, was awarded tenure, collegiate faculty in the Department of Biological Sciences.

Otto Folkerts, Associate Director of Technology Development at VBI
Photo credit: Jim Lo Scalzo

Workers do the shuffle: The Labor Force is Shifting Toward Science and Health

WASHINGTON (US News & World Report)– Even in the halcyon glow of economic prosperity, the American workforce is constantly transforming. Many economists expect the recession will only accelerate the long-term trends of automation, outsourcing, and the march of workers toward jobs in the service sector. The nation is now looking for ways to preserve resources, conserve energy, and reduce the 304 million or so environmental footprints of its residents. And the aging of the baby boom generation will continue to create need for healthcare services.

Some workers will be better positioned than others for the workforce of the future. If you're a 20-something with a knack for nursing, you'll be in good shape. If you earn a living by building pickup trucks, don't expect the government to save your job forever. Make no mistake, the ground is shifting, and the workforce is rearranging–permanently.

At Virginia Tech's Virginia Bioinformatics Institute, researchers are enthusiastic about the future of biology research and technology. In bioinformatics, the "wet lab" research is only half of the story; information technology is the other half. Otto Folkerts, associate director of technology development, says a new genome sequencer is speeding the process of sequencing a strawberry genome and a turkey genome, two of the institute's projects. "The volume of data we can generate . . . doubles, triples, or quadruples every year," Folkerts says. "The life sciences are being entirely transformed by the availability of these next-generation sequencing technologies." As researchers begin to understand how genomes work, they will gain insight into how, for example, strawberry crops can be improved. These advances carry over to human health, where the prospect of "personalized medicine"–studying individual human genomes–looms large.

Bioinformatics is an especially vibrant new area of biotech work, with plenty of opportunity for job growth, according to the Bureau of Labor Statistics. "As these new technologies and information become available, there's going to be a need for people who are very sophisticated," Folkerts says. Stephen Eubank, deputy director for the Network Dynamics and Simulation Science Laboratory at the Bioinformatics Institute, says that even in drug development, computer models will make up a greater part of research. "You can imagine a day when pharma can first turn to the computer [rather] than do clinical trial after clinical trial," Eubank says.

Source: US News & World Report, July, 2009

Café Scientifique returns for fall season with engaging speaker line-up

Café Scientifique is launching a new season with a roster of speakers scheduled for several Tuesday evenings this fall. The cafés are held once a month at Awful Arthur's restaurant on the corner of Draper Rd. and Washington St. in downtown Blacksburg, from 7 to 9 p.m.

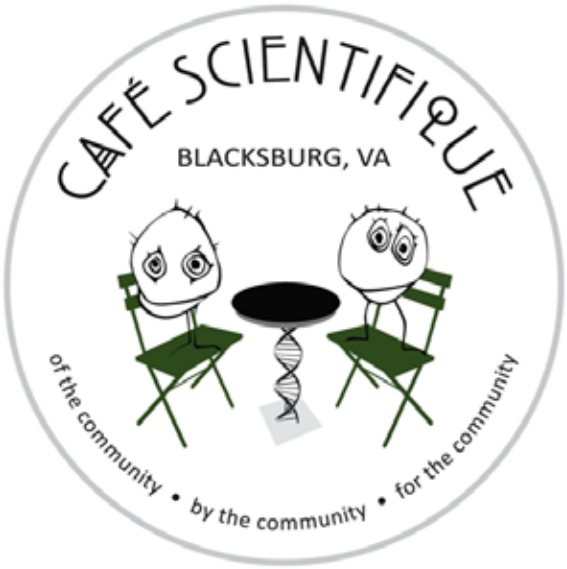
Café events are free and designed to encourage public attendance and participation. The format features a speaker who will spend 10-20 minutes introducing a topic, followed by audience participation in the form of discussion, question and answers, and lively debate. The first event of the new season took place on August 25. Marcella Kelly, associate professor in Virginia Tech's Department of Fisheries and Wildlife Sciences, and graduate research assistant Claudia Wultsch discussed their work tracking jaguars in Belize. Kelly's research program uses population dynamics and cutting-edge technology to promote conservation of wildlife species. Of particular interest are rare or elusive high-profile species, such as jaguars, that are notoriously difficult to study.

Through several non-invasive methods, including camera trapping and the use of former police dogs to locate jaguar feces samples, the pair is working to better understand the jaguar population density, sex ratio, and genetic diversity. This information is then used in population modeling, which can help conserve the species. As part of a collaborative project, Kelly developed the camera-trapping technique using infrared, remotely-triggered, motion-sensitive cameras that "capture" animals on film. The "capture histories" of each animal are analyzed to estimate the specific demographic parameters of the animal population. This research has produced the first density estimates of jaguar populations across four different study sites in Central and South America and provides new information for management and reserve design. Kelly and Wultsch were pleased to have the chance to share their research with an audience they may not normally reach.

"I was very impressed with the event," said Wultsch. "It is important to give these kinds of talks, which help to build a bridge between the public and the scientific world. People need to know what is going on in the natural world they live in. Educating and informing the public is crucial in our field of study, where many species struggle for survival in a human-dominated environment. Café Scientifique and other events like this provide researchers a forum where we can hopefully raise people's awareness of how endangered biodiversity is and how the newest scientific technologies help us to study and conserve species at the brink of extinction."

According to Kelly, "There were a lot of insightful questions that I might expect from scientists and I was very impressed with the general public's depth of knowledge. Because of the interactive environment of the café, a student from the engineering department had the chance to offer lots of interesting suggestions about how to improve the technology we use with remote cameras in wildlife sciences."

According to Darleen Baker, VBI project coordinator and organizer of the café, "The idea behind a science café is to create an atmosphere where anyone can come explore the latest ideas in science and technology, and we are committed to promoting public engagement with science. There is so much wonderful research going on at Virginia Tech and a science café not only allows people in the community to hear about that work first hand, but also provides the unique opportunity to ask questions about the work. By helping researchers to present their work in this casual, non-academic setting, we hope to foster more meaningful connections between the university and the public." ■



The following Café Scientifique speakers are scheduled through December, 2009:

- Tuesday, September 29, 2009
  Chris Roberts, associate professor, Virology, Department of Biomedical Sciences & Pathobiology, Virginia Tech
- Tuesday, October 27, 2009
  Michael Hochella, University Distinguished Professor, Geosciences, Virginia Tech
- Tuesday, November 24, 2009
  Brett Tyler, professor, Virginia Bioinformatics Institute and Plant Pathology, Physiology and Weed Science, Virginia Tech
- Tuesday, December 8, 2009
  Chris Lawrence, associate professor, Virginia Bioinformatics Institute and Department of Biological Sciences, Virginia Tech

VBI e_Connections is a quarterly publication of the Virginia Bioinformatics Institute produced by the Public Relations team. The newsletter includes feature articles, technology updates as well as interviews that may be of interest to VBI's audiences. Contributions are welcomed. Please direct submissions to newsletter-editor@vbi.vt.edu. Newsletter team: Susan Bland: Editor; Barry Whyte: Editor.

For further information, please contact: Barry Whyte at Tel: 540-231-1767, email: whyte@vbi.vt.edu. Website: www.vbi.vt.edu