



Introducing the UVM/VGN Proteomics Facility

by Bin Deng, PhD

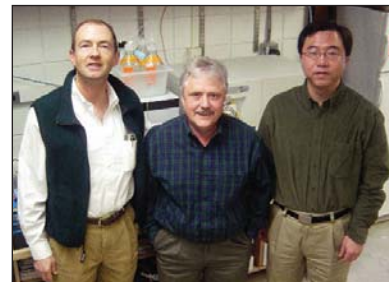
The Proteomics Facility is an interdisciplinary core facility in collaboration with the Department of Biology, Department of Chemistry, and the College of Medicine at the University of Vermont (UVM). The facility focuses on identifying, characterizing and quantifying the proteins expressed in biological and biomedical samples using mass spectrometry (MS). The goal of the facility is to offer a reliable, efficient and effective service for proteomics research and education needs of the UVM and VGN Baccalaureate Partner Institutions (BPI's) communities.

The facility has become a well-established resource with four mass spectrometers, including one of Applied Biosystems Voyager-DE Pro matrix-assisted laser desorption-time of flight mass spectrometer (MALDI-TOF-MS), one of Thermo-Finnigan LCQ Deca XP ion trap mass spectrometer plus liquid chromatograph (LC-MS), and two of Thermo-Finnigan LTQ linear quadrupole ion trap mass spectrometer plus nanoflow liquid chromatograph (nanoLC-MS). A major benefit of the mass spectrometry-based proteomics is that it provides new opportunities to find biomarkers for early diagnostics, new drug targets for superior therapeutics, correlate molecular mechanisms with disease, and enable a system study of biology. MALDI-TOF-MS is used to measure the molecular weight of peptides and examine the detailed structures based on the enzymatic fingerprinting of analyzed proteins. LC-MS is used to separate digested peptide mixtures with liquid chromatography, and then separated peptides can be directly introduced into tandem mass spectrometers for the identification of peptides and subsequently proteins. Coupled with multi-dimensional separation technologies, nanoLC-MS can perform trace analysis of proteins less than 100 femtomole level in complex mixtures such as human blood and cells. The facility has run hundreds of samples since last year, which included pro-

filings expressed proteins in tissues, human fluids, and cells, mapping sites of protein phosphorylation and other post-translational modifications, detecting target proteins in biological and biomedical samples, and de novo peptide sequencing.

The facility is led by Professor Dwight Matthews, who directs mass spectrometry instrumentation in several locations at UVM. Facility manager, Dr. Bin Deng, was recruited from Fred Hutchinson Cancer Research Center in Seattle last fall. Dr. Deng interacts with investigators and provides technical and scientific support to the proteomics projects. Jack Heim, senior technician, maintains the instruments, runs samples, and assists in data reduction.

The Proteomics Facility encourages researchers to contact and visit the facility to learn how mass spectrometry may assist them in their research. Researchers who have conducted experiments at the facility have been pleased that approximately 95% are getting "good hits" on their protein identification and characterization. We look forward to meeting the needs of our researchers as the facility grows.



(l-r) Dwight Matthews, PhD, Jack Heim, Bin Deng, PhD.



LTQ Linear Quadrupole Ion Trap Mass Spectrometer.

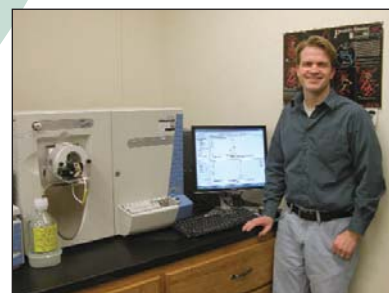
Proteomics – Mass Spectrometry Start-up Funding from the Vermont Genetics Network

by Bryan Ballif, PhD

Cells encounter a constant stream of all sorts of chemical and physical stimuli, much like we receive a barrage of stimuli when walking through a busy marketplace. Individual cells must appropriately interpret the signals they receive so they can react positively on behalf of their community. An appropriate cellular response for a white blood cell stimulated by its detection of a bacterium might include an attempt to engulf the bacterium. But to do so requires the coordinated mobilization of many hundreds of the cell's 10,000 or so proteins. Similarly, a large number of a cell's proteins must be coordinated when a cell is stimulated by a growth hormone to divide, or by an attractant to move, or even by a cell death signal to die (as is delivered to most rogue cells before they have a chance to turn cancerous, or to the cells that form the webbing of our embryonic hands). We have made much progress by identifying and tracking a handful of proteins at a time as they are mobilized in response to various stimuli, but we know that cellular responses

are often far greater in magnitude than engaging only a handful of proteins. Many proteins become chemically altered following a stimulus and we can thus know if they are reacting to or participating in a given response. Adding or removing atoms from a protein can not only change its structure and function, but it also changes its mass.

Dr. Bryan Ballif, a newly hired UVM Assistant Professor of Biology, studies molecular mechanisms of cell signaling. For his research, Bryan uses an instrument called a mass spectrometer that enables him to determine



Bryan Ballif, PhD receives start-up funding from VGN.

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VERMONT GENETICS NETWORK (VGN) INBRE

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Bioinformatics Core Director

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NCRR/NIH Grant #P20 RR16462

From the Director

*Judith Van Houten,
PhD*



Our second year of VGN's INBRE phase is well under way and much progress has been made. We are pleased to report that VGN will be hosting the Northeast Regional IDEa Conference here in Burlington on August 15-17, 2007. Representatives from our funding source, NIH, will be attending the conference. Also from NIH is our Keynote Speaker, Dr. James Battey, Director of National Institute on Deafness and other Communication Disorders (NIDCD), who will speak on Stem Cell Research. We look forward to getting together with our COBRE and INBRE colleagues from Maine, New Hampshire, Rhode Island and Delaware (Yes, NIH counts Delaware as with us in New England.) This meeting will serve as our annual meeting as well.

Our newest infrastructure project at UVM is a Proteomics Facility. Dr. Bin Deng is our newly appointed Proteomics Facility manager. Dr. Deng has been working with Dr. Dwight Matthews and Jack Heim to get the facility up and running. The facility, which houses two mass spectrometers purchased by VGN, is already available to researchers at UVM and our Baccalaureate Partner Institutions (BPI's). Please see <http://www.uvm.edu/~vgn/proteomics> for protocols and ways to contact Dr. Deng for expert advice.

We welcome two new faculty members who have received set up funding from VGN. Dr. Brian Ballif, Assistant Professor of Biology, who specializes in "large-scale proteomic approaches to decipher neuronal signal transduction networks" and Dr. Adam Lock, Assistant Professor of Dairy Science, who specializes in "the impact

Dr. Adam Lock Receives Start-up Funding from VGN

Dr. Adam L. Lock joined the faculty at the University of Vermont in September 2006 as an Assistant Professor in the Department of Animal Science. He was born and brought up on his family's dairy farm in the South-West of England, which his parents still run today. Dr. Lock received his B.Sc. (Hons.) degree from the University of Nottingham where he also went on to earn his Ph.D. in dairy nutrition focusing on the manipulation of milk fat composition.

of milk fat-derived /trans /fatty acids on cardiovascular disease".

We have had an extremely active Outreach Program. The **Microarray Outreach Team** has recently made its first visit to Marlboro College. Other scheduled visits for this spring are Middlebury College and Saint Michael's College. We have organized **Career Panel Presentations** at three colleges where a variety of professionals in science careers speak with the undergraduates about their career paths and possibilities. Plans are underway for our **Annual Career Day** at which VGN funded undergraduate students will be present their research and hear from a panel of professionals from a cross section of science and clinical careers.

Mentoring is an important part of VGN and INBREs, and our newest programs for career development of faculty and graduate students have been launched. Our first faculty **Professional Development Seminar** was held at Norwich University. We want to thank Dr. Ed Carney, VGN BPI Coordinator, for his help in organizing this function. VGN also held its first two official **Graduate Student Meetings**. We intend to have three or four meetings throughout the year at which our VGN funded graduate students are required to attend. A high light for next year will be a trip to NIH. Thanks go to Dr. Janet Murray for her leadership in organizing these meetings.

Part of building infrastructure is the process of making awards to faculty and undergraduates to build infrastructure and build cultures of research at the BPIs. Results of these competitions are ten faculty projects and five faculty pilot grants funded for grant year 3. The results of the student summer assistantships are not final at this point. Our graduate student assistantships for UVM students have been finalized with 4 lucky and talented students receiving year-long support that will free their time to concentrate on research with their faculty advisor.

Thank you all for making VGN a success as we build biomedical infrastructure in Vermont and make UVM a friendly resource for faculty and students across the state.

Following his Ph.D., Dr. Lock did his post-doctoral work also at the University of Nottingham focusing on the impact of nutrition on dairy cow fertility. In 2003 Dr. Lock was offered a Research Associate position at Cornell University work-



Dr. Adam L. Lock

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VGN Professional Development Seminar at Norwich University - February 10, 2007

The Vermont Genetics Network (VGN) hosted its first ever Professional Development Seminar on Saturday, February 10, 2007 at Norwich University. We would like to thank Dr. Ed Carney, Baccalaureate Partner Institution (BPI) Coordinator for his excellent work in organizing the function at Norwich.

The day began with a Continental Breakfast/Networking session. Faculty members from Castleton State College, Johnson State College, Middlebury College, Norwich University, Saint Michael's College and the University of Vermont welcomed the chance to meet face to face with their colleagues.

The morning officially began with a welcome from Associate Provost, Dr. Joe Byrne. He instructed the group to break up into two groups and each group attended one of the two concurrent workshops offered. One workshop, titled "How to Set up and Manage a Lab", was led by Dr. Bob Cluss, Professor of Chemistry and Biochemistry, Middlebury College. The other workshop titled "How to Mentor Undergraduate Students" was co-led by Dr. Jeffrey Byers, Professor of Chemistry and Biochemistry, Middlebury College and Dr. Mark Lubkowitz, Associate Professor of Biology, Saint Michael's College.

At noon, the entire group met for a buffet lunch. During lunch, Kerry Swift, MS, Technology Licensing Officer, Office of Sponsored Programs at the University of Vermont, gave a presentation on "Transfer Technology". After the lunchtime presentation, the group again broke up into two groups and each group attended the alternate workshop being offered.

Dr. Byrne brought the day to a close by thanking all the workshop leaders. In addition, he thanked the group for making the trip to Northfield on a Saturday.

The attendees enjoyed the Professional Development Seminar and offered suggestions on workshop topics for future seminars.

*Dr. Bob Cluss,
Middlebury College,
leads the "How to
Set up and Manage
a Lab" workshop.*



*Dr. Jeffrey Byers,
Middlebury College
and Dr. Mark
Lubkowitz, Saint
Michael's College
co-lead the
"Mentoring
Undergraduates"
workshop.*

*Kerry Swift,
University of
Vermont, gives a
presentation on
"Transfer
Technology".*



VGN Undergraduate Student Career Day

April 18, 2007 4:30 - 7:30 p.m.

DoubleTree Hotel
1117 Williston Road
South Burlington, VT 05403

Panelists

Lara Carlson, PhD *Assistant Professor, Department of Natural Sciences, Castleton State College*
Frances Carr, PhD *VP, Research and Graduate Studies, Provost's Office, University of Vermont*
Leslie Matthews, PhD *Environmental Scientist, Water Quality Division Dept. of Environmental Conservation, Vermont Agency of Natural Resources*
Alan Segal, MD *Director, Program in Nephrology and Hypertension, Dept. of Medicine, University of Vermont*

Castleton Career Panel Highlights Field Experience and Education

by Karen Lounsbury, PhD

The second round of science career panels started this academic year on November 17, with a diverse group of panelists presenting to a standing-room-only audience at Castleton State College. The panel was organized by myself and Dr. Mark Fox from Castleton. The feedback from last year's panel indicated a desire for panelists that had field experience or were earlier in their career, thus an effort was made to include representatives matching those requests. The panel consisted of four members including Francis Churchill, the Environmental Safety Compliance Manager for UVM, Katherine Traverse, a chemistry teacher at Fair Haven Union High School, Bethani Salerni, a graduate student at Dartmouth, and Nate Newman, a research technician at Dartmouth Medical College.

Francis Churchill described how he was motivated to use his BS degree in biology to do something to protect and improve the environment. He started out in field work monitoring and cleaning up hazardous waste sites and he came to UVM in 1993 to work on their hazardous waste projects. He was promoted to a managerial position as safety specialist and then in 2000 he shifted to his current position as environmental compliance manager. His position includes coordinating compliance activities for UVM's

hazardous waste management program, air pollution control program and oil storage program. He also helps arrange for emergency response to incidents that involve hazardous materials. In looking at his career path, Francis found that his interests were somewhat directed by his natural talents, and that having the right technical training put him in a position to be ready for the jobs he wanted.

Katherine Traverse described her indirect route to becoming a science teacher. Katherine graduated from UVM with a degree in environmental chemistry. She had several field experiences working for the Vermont



Castleton State College Career Panel Audience.

UVM/VGN Microarray Facility

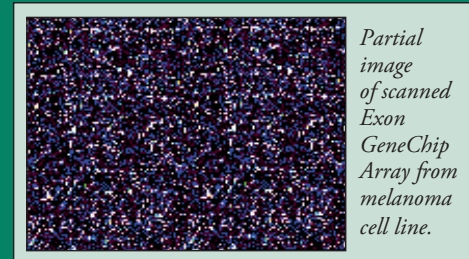
by Tim Hunter and Scott Tighe

The Microarray Core Facility continues to be instrumental in supporting global gene expression profiling and DNA mapping studies for the scientific community at UVM and colleges throughout Vermont. In collaboration with the Bioinformatics Core Facility, the microarray staff provides comprehensive support for all projects including experimental design, execution of sample processing, analysis, and troubleshooting if necessary. Currently, the facility staff has focused on the development, optimization, and implementation of two new services that will be beneficial to ongoing research studies.

As Formalin-fixed paraffin embedded (FFPE) samples become more desirable for genomic and transcriptional studies, the

need to generate good quality samples is required. Unfortunately due to the quality of nucleic acid obtained from these samples, they are often compromised and not suitable for use in standard microarray synthesis protocols. In response to this need, the microarray staff have developed an improved synthesis protocol of DNA extracted from FFPE samples for genotyping studies using the Affymetrix 500K SNP arrays. Human DNA mapping arrays have been available through the facility for two years and provide genomic level data such as single nucleotide polymorphisms, chromosomal copy numbers, and loss of heterozygosity.

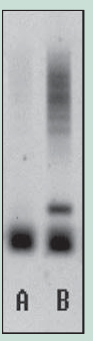
The latest technology added to the microarray core facility is full transcriptome analysis using exon arrays. This exon level-based approach allows researchers to simultaneously collect information on both gene expression



Partial image of scanned Exon GeneChip Array from melanoma cell line.

Gel image of amplified genome from FFPE sample using two protocols. Dark streak in "B" lane indicates successful amplification, while lane "A" indicates no amplification.

"A" lane = standard protocol
"B" lane = new protocol



Vermont Genetics Network Participates in the Northeast

by Timothy Hunter

The first annual Northeast Regional Life Sciences Core Directors meeting was held November 9-10, 2006 at Cornell University in Ithaca, NY. The goal of the conference was to provide an opportunity for networking among core directors and managers, interact with colleagues, share technical advice, and to discuss the challenges involved with the operation of shared research resource facilities and technologies. A secondary goal was the possibility that this could serve as a template for other regional meetings throughout the country. The two day meeting included talks on the importance of core facilities in life sciences research, core management challenges, networking resources and organizations, a poster session, and eight technology-focused breakout sessions in genomics, proteomics, bioinformatics, and information technology.

The Vermont Genetics Network (VGN) and VGN staff played a critical role in the funding, organization, content, and moderation of the technical

breakout sessions. VGN was one of seven regional entities to provide funding so the need to seek out vendor support would not be necessary and the meeting would be free of influences or pressures from marketing representatives.

Tim Hunter, manager of the Microarray and VCC DNA Analysis Facility, served as the meeting organizer, panelist on the Real-Time qRT-PCR roundtable, and presented a talk on "Management of Core Facilities". Hunter discussed core facility organization, staffing, oversight, services, quality control, user education, collaboration with other cores, facility promotion, budgeting, and community outreach activities. He emphasized the importance of the quality of data generated, how it is delivered and supported, and the ability to meet the changing demands of facility users.

Dr. Janet Murray, VGN Outreach Coordinator, gave a presentation on Vermont Genetics Network Outreach endeavors. She discussed the educational modules developed, how and where they are delivered, and the

Early Steps in Career Development

Department of Health including dropping rabies vaccine baits from airplanes and collecting ticks from animals to test for West Nile virus. She realized that she should use her excellent aptitude for communicating and thus took the opportunity to become a chemistry teacher. Similar to Francis's experience, it became her natural talent that eventually drove her towards her current career, and her technical training gave her the advantage when applying for jobs.

Bethani Salerni and Nate Newman are both recent graduates of Castleton State College, and the audience was very interested in hearing how their undergraduate training helped them in their career development. Bethani described her process towards becoming a graduate student in Pharmacology at Dartmouth, and answered questions related to GRE scores and how she fared as a Castleton graduate. Nate found that it was not difficult to obtain a technician-level position, but his lack of lab experience made the transition to a career in research very difficult. Both felt that Castleton prepared them well with respect to coursework, but both also felt that more research experience would have been very helpful. These comments highlight the importance of continuing the development of inde-

pendent research programs or creating summer internship programs for science undergraduates at the smaller Vermont colleges. Overall the students were left with many new ideas and concepts to think about when preparing to set out on their own career path.

In addition to the UVM Career Day scheduled in April, upcoming career panels are scheduled for this spring at sites including Norwich University, St. Michael's College, and Johnson State College.



Castleton State College Career Panel of Speakers.

and identify alternative splice variants that exist in the sample assayed by probing each exon. This differs from traditional approaches that are 3' biased and have little potential to distinguish alternative splice transcripts.

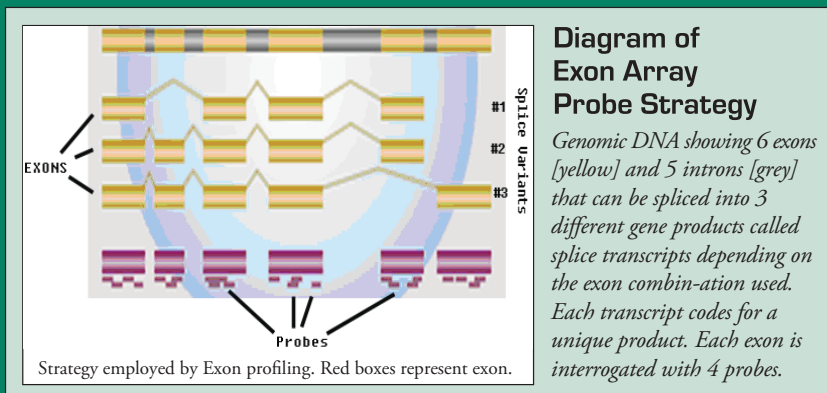
This technique requires a ribosomal reduction step to enrich for mRNA by depleting rRNA. This new technology has required the core facility to develop alternative protocols to meet the required concentration of synthesized template for the new Affymetrix GeneChip format. The first successful runs were completed in February and data analysis approaches are being investigated by the Bioinformatics Core staff.

The facility welcomes Jeff Holter into the microarray core lab during the spring semester as a laboratory intern. Jeff is a Norwich University senior who has participated in the VGN outreach microarray educational module during the spring of 2005 at Norwich University. Jeff will be learning biomolecular techniques used in both the Microarray and VCC DNA Analysis facility while also assist-



Intern Jeff Holter

ing with the development of a new microarray experiment to be used in a new teaching module. The experiment will focus on determining gene expression of the yeast *Schizosaccharomyces pombe* when exposed to oxidative stress. Jeff will be the third student from the BPI colleges to intern in the microarray core facility since the inception of the VGN outreach program.

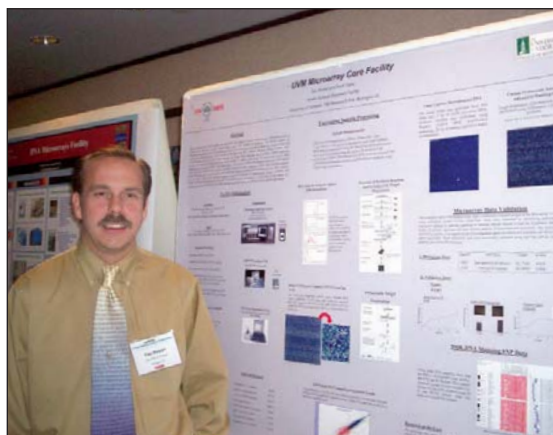


Regional Core Directors Meeting

positive outcomes. Dr. Murray discussed the importance of these educational contacts in the development of collaborations with other Vermont Colleges and the access to technologies provided.

Scott Tighe, Senior Research Technician in the Microarray Core facility, organized and moderated the technology break out session on Flow Cytometry. Tighe moderated discussions beneficial to other technologies such as establishing standard operating procedures for ensuring RNA integrity while sorting cell types for downstream applications such as microarray.

A web based exit survey indicated the participants found the meeting informative to their "home cores" and would like to see this become an annual event on networking, sharing ideas, and to keep the focus on core facility operational issues. Further information from this meeting can be found at <http://nerlscd.biotech.cornell.edu>.



Timothy Hunter presents a poster at the NE Regional Core Directors Meeting.

Microarray Outreach at Lyndon State College and Marlboro College

by Janet Murray, PhD

Throughout the fall of 2006 and spring of 2007 we have continued to expand our microarray outreach program with the addition of two new sites, Lyndon State College and Marlboro College. Students at eight baccalaureate colleges throughout the state of Vermont have now had the opportunity to learn about microarray technology using hands-on laboratory experiences. In this standard module, baker's yeast is treated with an environmental contaminant to examine the changes in the gene expression profile induced by this environmental stress.

One of the major goals in the development of this module was to see this technology integrated into science curriculum of baccalaureate colleges throughout Vermont. Professor Elizabeth Dolci at Johnson

State College was the first to repeat the microarray module in the spring of 2006 and intends to continue to deliver this in her lab course biannually. In the spring of 2007 this technology is being delivered for the

second time at St. Michael's College and Middlebury College. In the process of integrating this technology both Mark Lubkowitz, PhD at St. Michael's



Microarray Outreach at Lyndon State College.

College and Jeremy Ward, PhD at Middlebury College have decided to modify the experiment to integrate the technology more effectively with their curricula. The students at Saint Michael's College will still be using baker's yeast as the experimental organism but will be comparing the expression profile of wild-type yeast to a strain with a specific mutation developed at their college. The students at Middlebury College are conducting an experiment with a human cell line treated with a chemical that induces specific developmental changes. Middlebury will be the first outreach site to change organisms. We encourage outreach sites to make changes in the organism and experimental protocols to fit into their individual curricula. We anticipate re-delivery of the microarray outreach module to Green Mountain College and Norwich University in the fall of 2007 in their effort to integrate this technology into their curriculum as well.



Microarray Outreach at Marlboro College.

Bioinformatics Module Beta Test

by Janet Murray, PhD

In the fall of 2006 the Vermont Genetics Network outreach team beta tested the VGN bioinformatics module at the University of Vermont. This module was developed in collaboration with Professor William Barnes on sabbatical from Clarion University in Pennsylvania. This module is designed to train students in the use of several NCBI and other web based tools.

With the rapid advances in scientific technology and computational tools there are vast amounts of scientific knowledge at our fingertips.

The trick is learning how to access it effectively and gain familiarity with existing tools for data-mining and analysis.

The VGN bioinformatics module is designed to introduce principal databases and tools to

students. Students are lead through an online tutorial with exercises during the class and given weekly assignment for independent projects. The students learn how to effectively search literature databases, find sequence information and conduct blast searches. The students then do multiple sequence alignments and phylogenetic analysis as well as working with protein structure databases and 3D structural viewers. The module ends with the students presenting their own independent project describing a disease and the genetic and structural changes associated with the disease phenotype.

This course is currently delivered as a package but the organization of this module would be very conducive for teaching different bioinformatics applications separately as well. We see the potential for faculty at our outreach sites to choose from portions of this tutorial for use in specific courses or for specific projects.

We would like to thank Professor Patrick Reed and Courtney Scott for opening the Applied Molecular Biology lab course for our use in further developing this module. As with any new curriculum the real test comes when the students get their hands on it. We would like to thank the students in this course for their time, curriculum assessments and their patience with some of the bugs associated with online tools and tutorials.

We are anticipating our first outreach delivery of the VGN bioinformatics module for the fall of 2007. For more information about this module or other outreach activity please feel free to contact Janet Murray at Janet.Murray@uvm.edu.



Janet Murray, PhD (center) instructs students.



Vermont Genetics Network

is hosting the

2007 NE Regional IDeA Meeting of INBREs and COBREs

in Vermont, New Hampshire, Maine, Rhode Island and Delaware

August 15 - 17, 2007

Sheraton Hotel and Conference Center
Burlington, Vermont

Keynote Address

“The Promise and Challenge of Stem Cell Research”

James Battey, M.D., Ph.D.

Director, National Institute on Deafness and other Communication Disorders, NIDCD
National Institutes of Health

Registration Available!

<https://www.uvm.edu/~vgn/ideameeting/registration.php>

Dr. Lock Receives Start-up Funding from VGN *continued from page 2*

ing with Dr. Dale E. Bauman.

At Cornell, Dr. Lock's research focus involved the regulation and manipulation of ruminant lipid metabolism, allowing improvements in the efficiency of animal production and providing opportunities to design foods that are consistent with consumer perceptions and dietary recommendations. The effect of diet on milk fat synthesis and the production of dairy-based functional foods with enhanced benefits for human health were of special interest. During this research Dr. Lock became interested in extending these efforts into examining the impact of dairy-based functional foods on human health. This has subsequently resulted in collaborative efforts examining the effects of modified milk fat on mammary cancer with scientists at Roswell Park Cancer Institute, and cholesterol and lipoprotein metabolism with former colleagues at the Universality of Nottingham. Recently, Dr. Lock was involved in a large international collaboration to examine the impact of milk fat-derived *trans* fatty acids on cholesterol markers of atherosclerosis in humans. In 2001 Dr. Lock was presented with the British Society of Animal Science Young Scientist Award and in 2005 the Dairy Industry Association of Australia Technical Award. Dr. Lock has published 16 peer-reviewed publications, 8 book chapters and reviews, 18 conference proceedings and over 40 abstracts. Later this year, Dr. Lock will be an invited speaker at the International Dairy Federations World Dairy Congress, where he will speak on his, and his colleagues, work on *trans* fatty acids.

With his training in the dairy sciences and previous collaborative experience with biomedical models of human health Dr. Lock's future goal is to build on these experiences and incorporate both of these aspects

into his own research program thereby better integrating the dairy and medical sciences. According to Dr. Lock, “With the recent move to the University of Vermont I am extremely excited by the opportunity to set up my own research program and also the potential to collaborate with colleagues in the College of Medicine”. Dr. Lock's current focus will examine the effect of milk fat-derived bioactive fatty acids, in particular *trans* fatty acids and conjugated linoleic acids, on inflammatory markers of atherosclerosis. In support of these efforts, VGN provided Dr. Lock with start-up funds for his new laboratory and research program.

Proteomics – Mass Spectrometry Start-up Funding *continued from page 1*

precise mass changes in hundreds to thousands of proteins following exposure of a cell to a given stimulus. Through the support of a VGN funded mass spectrometer, Bryan is focusing his research on stimuli that form the central nervous system. Bryan earned his doctoral degree in 2001 from Harvard University where he studied the molecular mechanisms of cell survival in the laboratory of Dr. John Blenis. He then studied for two years in the laboratory of Dr. Jonathan Cooper at the Fred Hutchinson Cancer Research Center in Seattle where he pursued interests in signaling mechanisms of the developing brain. Just prior to his appointment to the Department of Biology at UVM, Dr. Ballif trained for three years at Harvard Medical School in mass spectrometry-based proteomics in the laboratory of Dr. Steven Gygi.

Grants Awarded For VGN's Project Year 3

BPI FACULTY PROJECT GRANTS

10 Awards Totaling \$648,750

- 2 - Castleton State College
- 2 - Middlebury College
- 3 - Norwich University
- 3 - Saint Michael's College

BPI FACULTY PILOT PROJECTS

5 Awards Totaling \$125,000

- 1 - Johnson State College
- 2 - Middlebury College
- 2 - Norwich University

BPI STUDENT SUMMER RESEARCH GRANTS

8 Awards Totaling \$36,000

- 1 - Castleton State College
- 1 - Johnson State College
- 2 - Middlebury College
- 2 - Norwich University
- 2 - Saint Michael's College

UVM GRADUATE STUDENT ASSISTANTSHIPS

4 Awards Totaling \$120,000

Congratulations to all of the newly funded VGN Researchers!

National Center for
Research Resources



RETURN SERVICE REQUESTED

University of Vermont
120A Marsh Life Science Building
Burlington, Vermont 05405-0086

Vermont Genetics Network



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