



## VGN Awarded \$2.12M in Supplement Funding

The Vermont Genetics Network has been awarded \$2,121,240 in supplement funds from the National Institutes of Health. The funds were awarded through two requests for Administrative Supplements to the existing VGN INBRE award as part of the American Recovery and Reinvestment Act of 2009 (ARRA).

Over \$1.7M was awarded under an Advance Translational Research supplement as Vermont's part of a regional effort from five northeast IDEA states (VT, NH, ME, RI and DE) to provide the first fiber-optic backbone through northern New England (Figure 1). This network will connect higher education and biomedical research institutions for research and workforce development.

The five north eastern states formed the North East Cyber-infrastructure Consortium (NECC) several years ago and have been working together to establish a redundant fiber network through the region. Each state has been successfully building biomedical research infrastructure through both INBRE and COBRE programs. NECC members have combined resources and expertise to pursue large-scale regional genomics and metagenomics studies as well as regional workforce development programs. These projects hinge upon cyber infrastructure that will be provided by our fiber optic backbone for regional connectivity.

Lead institutions in the five NECC states submitted linked INBRE Administrative Supplements to establish specific parts of a proposed fiber network. The VGN award will primarily fund long-term exclusive access to 10 Gb of fiber optic bandwidth from the University of Vermont to Internet2 and internet backbone connections in the northeast. NECC members were also recently awarded funds from a joint NSF proposal to build additional parts of this same regional network.

The linked NECC supplement awards will fund the development of a regional shared data center. This data center will enhance the ability to carry out large-scale collaborative research projects in a variety of scientific disciplines by obviating the need for individual researchers to manage very large data sets. The VGN supplement award funds the creation of a new

position within the VGN Bioinformatics Core to support development of the shared data center in collaboration with other NECC personnel.

A second VGN administrative supplement of just under \$400,000 was awarded for a metagenomic study of blue-green algae blooms in Lake Champlain. The project aims to develop an understanding of the dynamics of these toxic cyanobacterial blooms through genomic sequencing of the microbial communities present over the time course of a bloom. This award funds the creation of a new position in the VGN Bioinformatics Core for the pilot

project. The metagenomic study will make use of the newly established NECC shared data center.

The supplement awards meet the high priorities of the ARRA for job creation, economic impact, cyberinfrastructure development and geographic diversity of biomedical research. The NECC regional fiber network and shared data center will promote modern genomics and health informatics research in a region that is almost devoid of fiber backbone. The creation of two new positions within VGN will have a direct impact on the local economy.

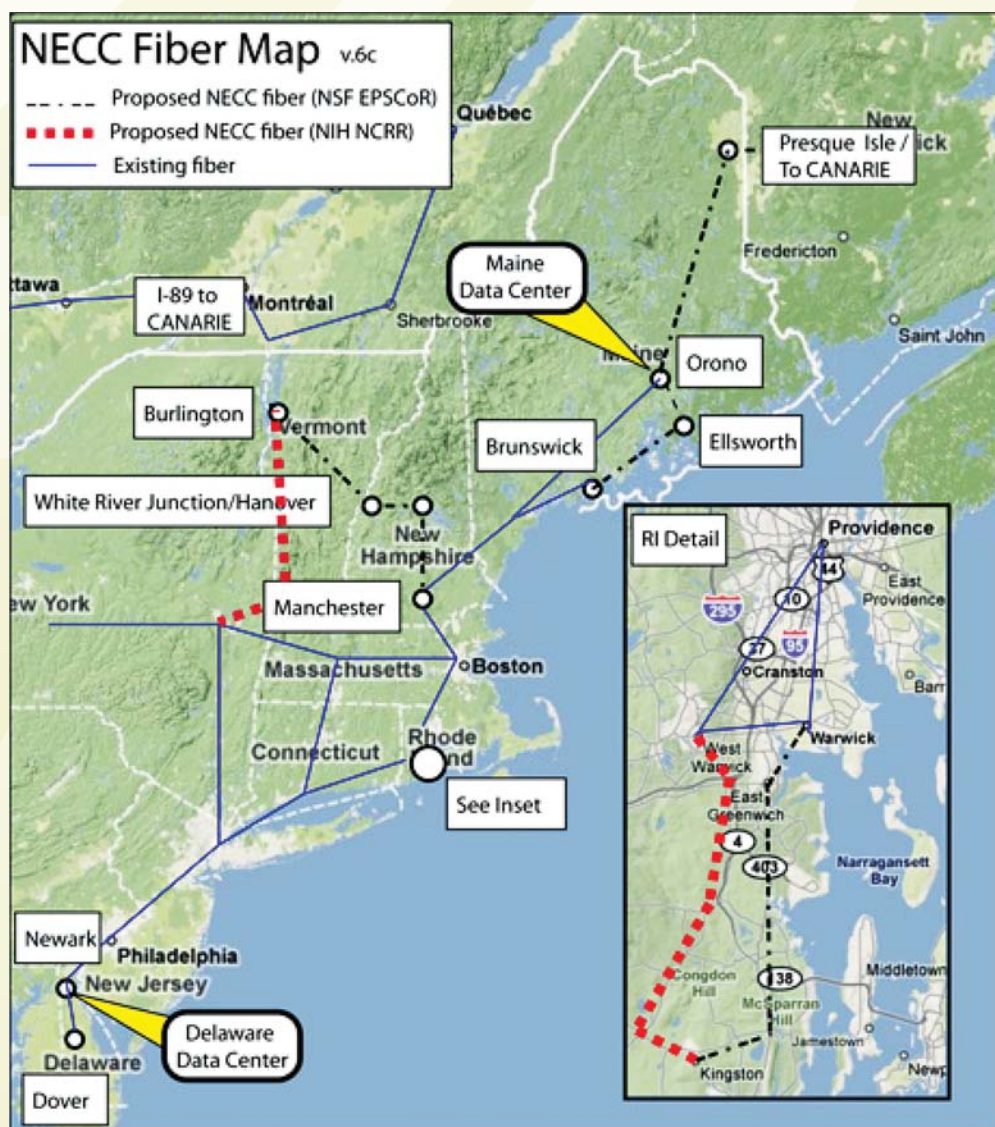


Figure 1: NECC proposed regional network.





## Vermont Genetics Network (VGN) INBRE

### *Director*

Judith Van Houten, PhD

### *Associate Director*

Kelvin Chu, PhD

### *Outreach Core Director*

Christopher Allen, PhD

### *Bioinformatics Core Director*

James Vincent, PhD

### *Undergraduate Networking and Professional Development Director*

Karen Lounsbury, PhD

## Baccalaureate Partner Institutions & Coordinators

### *Castleton State College*

Honoree Fleming, PhD

### *Green Mountain College*

Natalie Coe, PhD

### *Johnson State College*

Elizabeth Dolci, PhD

### *Lyndon State College*

Alan Giese, PhD

### *Middlebury College*

Robert Cluss, PhD

### *Norwich University*

Scott Page, PhD

### *Saint Michael's College*

Alayne Schroll, PhD

## VGN Staff

### *Program Manager*

Julie Paris

### *Business Manager*

Nathan Besio

### *Program Assistant*

Cheryl Farnum Rendino

### *IT Specialist*

Bryan Fleming

## VERMONT GENETICS NETWORK

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NCRR/NIH Grant #P20 RR16462

## FROM THE DIRECTOR

Judith  
Van Houten,  
PhD



I am pleased to provide you with an update on VGN as we move into our fifth year of INBRE funding. This has been a busy and exciting time for VGN as we have submitted our renewal application for continued funding with NIH/NCRR. Thanks go to all of you who provided help in the submission. In addition to our renewal application, we submitted four requests for Administrative Supplements, two of which were funded. These supplements provide stimulus funding for an optical fiber network among Vermont, New Hampshire, Maine, Rhode Island and Delaware and a pilot research project.

Our BPI Coordinators organized the **3rd Annual VGN Faculty Professional Development Seminar** that was held on Saturday, January 24th at Middlebury College. The topic for the seminar was "The Research Friendly Curriculum – Integration of Undergraduate Research and Teaching" and the speaker was Dr. Bert Holmes, NSF Program Office Division of Undergraduate Education and Carson Distinguished Chair of Science at the University of North Carolina, Asheville. Following Dr. Holmes' presentation, three of our BPI faculty members spoke about their own examples of best practices at their institution. We at VGN would like to thank Middlebury College BPI Coordinator Dr. Bob Cluss and Grants Manager, Franci Farnsworth for their efforts in hosting the event.

VGN students and their advisors made our **8th Annual Career Day** a great success. We gathered on April 15th at the Doubletree Hotel. Dr. Karen Lounsbury, VGN Director of Networking & Professional Development organized a panel of four speakers who told us about their individual career paths. The undergraduate students also presented their VGN research in a poster presentation. Hussein RH Alramini and Kevin O'Rourke, both from Middlebury College received prizes for the best posters. Congratulations!

Our most important event, our **8th Annual Retreat** was held on August 12th at the Doubletree Hotel. We were delighted that Dr. David Asai, Director of Precollege & Undergraduate Science Education,

Howard Hughes Medical Institute delivered the keynote presentation titled, "Peripatetic Wanderings: Dynein and Me." Three VGN funded researchers also gave presentations about their research while other researchers presented their research in a poster session. Continuing our new tradition Nathan Besio, VGN Business Manager hosted a Business & Grant Managers meeting for our BPI's.

Our **VGN Proteomics Facility Open House** is becoming a tradition. The 3rd Open House was held on August 25 at the University of Vermont. The open house was organized by Dr. Bin Deng, VGN Proteomics Facility Manager. This event continues to be an effective way to introduce researchers to the services available from the Proteomics Facility. Our facility is expanding its services and our Proteomics Facility Staff can be reached for a consultation through the following link (<http://vgn.uvm.edu/proteomics/>).

VGN would like to congratulate the following VGN Staff and Faculty for their promotions this year. **Dr. Bin Deng**, Proteomics Facility Manager has been promoted to UVM Research Assistant Professor and Julie Paris, has been promoted to VGN Program Manager. VGN has also welcomed some new faces this year. **Dr. Kelvin Chu**, Associate Professor of Physics and Associate Director of Vermont EPSCoR is now the Associate Director of VGN. **Dr. Julie Dragon** is the new Research Analyst in our Bioinformatics Core. **Cheryl Farnum Rendino** has joined us as the new VGN Program Assistant.

Congratulations to our BPI faculty who submitted meritorious applications for nine project awards and five pilot awards. Please see the box to the right for the PI names and project titles. Please welcome and congratulate all of our VGN members along with me. I wish you all another successful and productive year and thank you for making VGN a success.

*Save the Date!*

9th Annual  
**Career Day**

April 14, 2010  
4:30 - 7:30 pm

Double Tree Hotel  
South Burlington, VT



## VGN PROJECT AWARD WINNERS

**Natalia Blank PhD, Norwich University**  
"Synthesis of Chiral 1,2-diamines via Asymmetric Addition of RLi to 1,2-diimines"

**Kim Cronise PhD, Middlebury College**  
"Is Tolerance an Enabling Factor for Greater Alcohol Consumption?"

**Alison Fisher PhD, Norwich University**  
"The Molecular Mechanism of Ethylene Regulation of Photoperiodic Plant Flowering"

**Kevin Fleming PhD, Norwich University**  
"Vigilance and Threat Perception in Military Veterans and Cadets"

**Hans Haverkamp PhD, Johnson State College**  
"Baseline Airway Mechanical Function and Airway Function During Exercise in Asthma"

**Ari Kirshenbaum PhD, Saint Michael's College**  
"Psychomotor Stimulant Induced Sensitization of Impulsive Behavior"

**Shane Lamos PhD, Saint Michael's College**  
"New Chemical Tools for the Quantitative Assessment of Biological Metabolomes"

**Mark Spritzer PhD, Middlebury College**  
"Effects of Testosterone on Social Interactions on Memory and Adult Neurogenesis"

**Elizabeth Wuorinen PhD, Norwich University**  
"Exercise Intensity Effects on Weight and Fat Loss in Middle Aged Adults"

## VGN PILOT PILOT AWARD WINNERS

**Elizabeth Dolci PhD, Johnson State College**  
"Metagenomic Analysis of the Lowell/Eden Asbestos Mine"

**Joanna Ellis-Monaghan PhD, Saint Michael's College**  
"Graph Polynomials and DNA Structures"

**Karen Hinkle PhD, Norwich University**  
"Lampricide-Induced Growth and Morphological Alterations in *Saccharomyces cerevisiae*"

**Gina Mireault PhD, Johnson State College**  
"Infant Humor and Temperament from 3 to 6 Months and Attachment at One Year"

**Carlos Velez Blasini PhD, Middlebury College**  
"An Internet-Based Personalized Norm Intervention to Reduce Risky Behavior"

**congrats to:**

**Dr. James Vincent,  
Director, Bioinformatics Core  
for a patent he was  
granted through work  
with a team at the  
National Cancer Institute  
for chemotherapy drug work.**

## BIOINFORMATICS BOOT CAMP

The Vermont Genetics Network Bioinformatics Core will offer a series of short, hands on sessions in basic bioinformatics techniques. The sessions are designed for researchers who need a quick jump start in basic bioinformatics for their research and for students who have an interest in learning bioinformatics. The goal of the sessions is to introduce basic techniques and information sources related to bioinformatics such that researchers will have a starting point for their own particular needs.

Each topic will be covered in a single thirty-minute session. Sessions will be held once each morning for five consecutive days, Monday through Friday. In keeping with the tradition of boot camps, these sessions will be offered at 7:20AM - yes, 7:20AM - so as not to interfere with class schedules.

A computer will be provided for each participant if needed.

Interested undergraduate and graduate students, post doctoral fellows and other researchers are encouraged to sign up early as attendance is limited.

### Session Topics

- Overview of Major Sequence Databases and Portals
- Sequence Similarity Searching (BLAST)
- Multiple Sequence Alignment
- Using DAVID to Annotate Lists of Genes
- Genome Browsers

**Signup & Questions:**  
**James.Vincent@uvm.edu**



Nathan Besio, VGN Business Manager was recently appointed to the State of Vermont Human Rights Commission by Governor Jim Douglas. Nate is one of five commissioners in Vermont and has been appointed for a five year term with the HRC.

The mission of the Human Rights Commission is to promote full civil and human rights in the state of Vermont. They pursue this mission by enforcing laws, mediating disputes, educating the public, providing information and referrals and advancing effective public policies on human rights. For example, in 2008 the Commission staff participated in over fifty different education and outreach efforts. Some of these meetings included: ADA Coalition, Vermont Affordable Housing Coalition, Addison County Migrant Workers Coalition, Home Share, and Champlain Valley Union High School.

The ultimate goal of the HRC is to

create a society in Vermont where citizens act effectively to end discrimination, collaborate with public, private, and non-profit organizations, and conduct efficient and effective enforcement of the law.

If you'd like to read more about what Nate does in his spare time you can find more information at (<http://hrc.vermont.gov/>).





# VERMONT GENETICS NETWORK 8TH

Vermont Genetics Network hosted its 7th Annual Career Day on April 15th at the Doubletree Hotel in South Burlington, Vermont. Undergraduate students from UVM and our five Baccalaureate Partner Institutions (BPIs) (Castleton State College, Johnson State College, Middlebury College, Norwich University and Saint Michael's College) attended the event along with their faculty advisors. Other faculty and staff from

these schools attended as well.

The evening began with student poster presentations. Undergraduate students that received funding from VGN for INBRE Project Year Four presented posters describing their research projects. Students who worked directly for VGN funded faculty researchers were also invited to share the work they had done. The poster presentations were excellent and met with interest by all attendees. A panel of judges chose two winning posters from the students who received VGN funding and an 8GB flash drive was awarded to each winner. The winners were Hussein R H Alramini of Middlebury College and Kevin O'Rourke of Middlebury College.

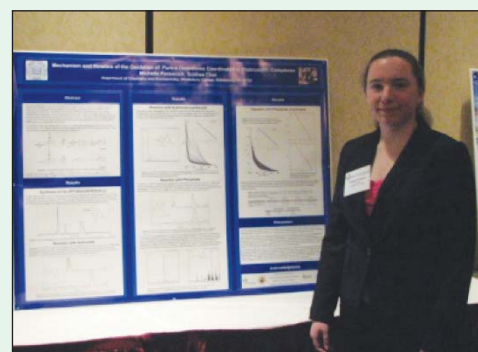
A buffet dinner followed the presentations. After dinner, Dr. Karen Lounsbury, Director of Networking & Professional Development for VGN, officially welcomed the guests and introduced the panel of speakers. The presentations focused on the individual career paths that each panelist took to arrive at their current careers.



Dr. Karen Lounsbury,  
Director of Networking &  
Professional Development, VGN



Hussein R H Alramini, Middlebury College  
Timothy Hunter, VGN



Michelle Personick, Middlebury College

## DR. KAREN LOUNSBURY INTERVIEWS DR. ROBINSON FULWEILER

### Interview Questions:

1. *Was your choice of career as a professor in Earth Sciences based more on opportunity, on your pursuit of a specific career, or something else?*

My career in science really started as luck. I knew I liked science but I had no idea what I wanted to do for a career. I was hired as laboratory help one summer at the Graduate School of Oceanography—and I loved it. I was lucky enough to be in a very dynamic lab that gave me lots of responsibility and opened my eyes to the world of “doing” science. That one summer changed my whole life.

After that I entered graduate school and was very much focused on making it to a tenure track position. So being here, in the Earth Sciences Department at Boston University, is a dream come true!

2. *Did you have training or experience outside of required class work that helped to prepare you for your career?*

The more I do this—the more I realize that most life experiences helps you succeed in other areas of life—and sometimes in unexpected ways. I grew up on the water and worked at a marina for many years. Of course I learned a lot about boats—which helps in my line of work—but I also learned how to deal with customers and manage a team of people. Those skills are absolutely necessary and invaluable.

I think laboratory work is great too. I recommend to all of my students interested in science that they should try their hand at lab work—it shows you how people work, what goes on in a lab, and a glimpse how science is done.

Experiences that open your eyes and build your confidence are key. Even if it's just learning something new or conquering a fear—all helps. Then when you are feeling discouraged you can pull on those positive moments and carry on.

The key is to remember that there is so much learning to do outside of the classroom!

3. *Do you have a specific story you'd like to share about your experiences that led to deciding your career path?*

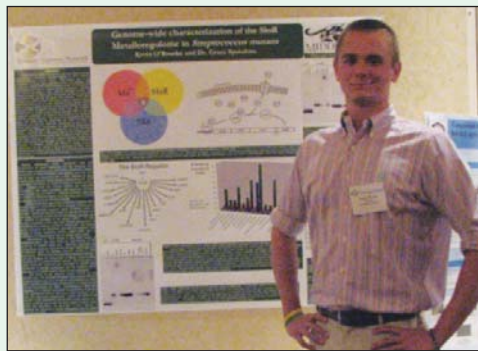
My story is a long one and quite different than many other people in my current position. I think the best thing to say is that it is very important to keep your mind open. And if you don't know what you want to do—that's ok, in fact that might be great! It means that you will be able to take advantage of the different opportunities that come your way. Ultimately, do something you are passionate about. Go for the passion! It will make getting up and going to work a joy—at least a majority of the time.

4. *Do you perceive that there are a lot of job opportunities in the basic sciences, or will there be in the future?*

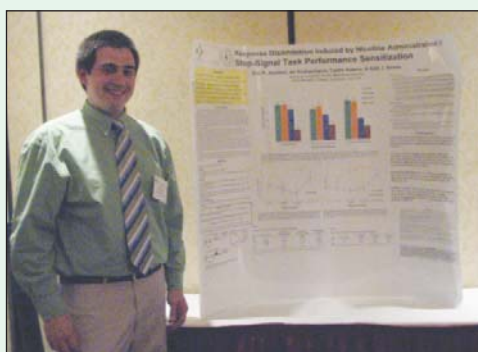
Absolutely — there is so much work to do! Science is the key to dealing with the many challenges we face in the future—from sea level rise to freshwater shortages. And we need to educate the next generation.



# ANNUAL CAREER DAY APRIL 15, 2009



Kevin O'Rourke, Middlebury College



Eric Jackson, Saint Michaels College



Robinson W. Fulweiler, Ph.D.  
Assistant Professor  
Department of Earth Sciences  
Boston University

A recurring theme throughout all of the panelists' presentations was that their current career was not necessarily their original goal, and that their career paths included a mixture of opportunities and choices that guided them to their current positions. Lee Ann Banks' science career started with a Chemical Engineering degree, but she decided to take 5 yrs away from her career to care for her young children. She re-entered the science field by pursuing a master's degree in civil/environmental engineering which opened the opportunity for her current position as an Environmental Compliance Manager for the Vermont Army National Guard. Her story shows that a break in career is not necessarily the end of a career.

Kerry Swift got her master's degree in Molecular Biology at Tufts University. She then spent 6 years working at MIT's Technology Licensing Office before relocating to Vermont for family reasons. Because of her positive networking and valued experience, her colleagues at the University of Vermont were able to create a new position for her where she has since successfully expanded the technology transfer services.

Michael Hillinger took a fully entrepreneurial career path. He obtained a Ph.D. in Cognitive Psychology, but was interested in combining his understanding of human cognitive processes with instructional technology to create innovative models of technology-based learning. He has taken his interests down several paths, and has worked both as a technology software consultant and as Director of Learning Technologies at Norwich University Applied Research Institute. His propensity to take enormous risks in his career was very impressive.

Robinson (Wally) Fulweiler originally had no intentions of studying for her doctorate, yet her path led from the University of Vermont to a Ph.D. in Oceanography from the University of Rhode Island. She shared several amusing anecdotes about her struggle to find direction. She hasn't looked back and is now studying wetland ecology as an Assistant Professor in the Earth Sciences department at Boston University.

Questions from the audience centered on job opportunities, perhaps not surprising given the current economic climate. The answers focused on advice to pursue a

scientific passion because if you have passion for your work, you will be more successful at generating opportunities for yourself. In all, the students gained insight into the many paths that can lead to success in science, and the panelists learned a little more about themselves in the process.



Michael Hillinger, Ph.D.  
Director, Learning Sciences Division  
MIRACORP, Inc.



Kerry Swift, M.S.  
Associate Director of Technology Transfer  
University of Vermont



Lee Ann Banks, P.E.  
Environmental Compliance Manager  
Vermont Army National Guard

## VERMONT GENETICS NETWORK PARTICIPATES IN NORTHEAST REGIONAL IDeA STATES MEETING

The Northeast Regional IDeA States meeting was held at the Mountain Grand View in Whitefield, NH August 5-7, 2009 and hosted by Dartmouth College. This regional meeting brought investigators from the IDeA States in the region including Delaware, Maine, Rhode Island, New Hampshire, and Vermont.

Jim Vincent, VGN Bioinformatics Core Director, presented a talk on a proposed metagenomics research study that has recently been funded by the NSF. The study goal is to determine the microbial community composition of cyanobacteria blooms within the region (NH, RI, ME, VT) using next generation sequencing technology. This study will also make use of a new regional Shared

Data Center funded under the same NSF grant.

Scott Tighe of the VGN Microarray Facility presented a talk in the Genomics Workshop addressing best approaches to generate microarray data and stressed the value of upfront quality control for sample input that can be applied to microarray as well as other downstream technologies. He also presented research data from a study performed by the VGN microarray facility which focused on optimal target amplification strategies to circumvent the affects of compromised RNA.

Tim Hunter, Manager VGN Microarray Facility, discussed the sharing of core resources and the tools that can help facilitate the process in a Core Facility Workshop. He presented the Vermont Genetics Network Core Facility Database as a primary tool for identifying regional and national resources and showed examples of how regional resources have

been leveraged through this database. He discussed the need to work together regionally and the possibility of regional resources in the future.

Bryan Ballif, Co-Director of the Proteomics Facility, along with Scott Gerber from Dartmouth Medical School, conducted a proteomics workshop. The workshop included two presentations that described the fundamentals of modern-day proteomics, including theoretical principles, experimental designs & approaches, data collection and interpretation (Gerber), followed by a real-world example of proteomics in practice to publication (Ballif). There was also an important discussion about the roles and distinctions between project types conducted in a core facility and those conducted in a proteomics research lab. Bryan also presented proteomics research work from his own lab in a separate session.

### LIZ LERMAN DANCE EXCHANGE

The Vermont Genetics Network (VGN) Outreach Program hosted the Liz Lerman Dance Exchange in their performance of the Ferocious Beauty: Genome at the Flynn Center for the Performing Arts in Burlington, Vermont.

An afternoon educational performance was provided for local middle and high school students. Educators could participate in a workshop and educational materials were available online. This performance was tailored to the students with Liz Lerman herself introducing each dance segment and how it related to the scientific topic and/or ethical question being depicted in dance.

The evening performance reached out to the community and the subject area was expanded addressing more in depth ethical issues. At the end of the performance a panel was assembled with Liz Lerman, a representative from the Flynn Center and some of the performers. Also featured on the panel were James Vincent PhD the VGN Bioinformatics Director and Janet Murray PhD the VGN Outreach Coordinator who described their scientific expertise and commented on the matinee and evening performances. The performances inspired conversations on genetics and the future of science, and made this subject area accessible to a diverse group of community members and students.

## 3RD ANNUAL VGN FACULTY PROFESSIONAL DEVELOPMENT SEMINAR

HOSTED BY MIDDLEBURY COLLEGE • SATURDAY, JANUARY 24, 2009

The Baccalaureate Partner Institution (BPI) Coordinators planned and hosted their 3rd Professional Development Seminar which was held at Middlebury College on Saturday, January 24, 2009. The topic for the seminar was "The Research-Friendly Curriculum – Integration of Undergraduate Research and Teaching" and the speaker was Dr. Bert Holmes, NSF Program Office Division of Undergraduate Education and Carson Distinguished Chair of Science at the University of North Carolina, Asheville. Faculty members from all of VGN's BPIs attended and enjoyed networking while enjoying a continental breakfast.

The program officially began with a lively and interactive presentation by Dr. Bert Holmes. He spoke about different models and approaches of integrating undergraduate research and teaching. His presentation was met with questions and insights from many of the BPI faculty members in attendance.

Following Dr. Holmes' presentation, three BPI faculty members spoke about their own examples of best practices at their institution. The panel included: Kevin Fleming, PhD, Norwich University, Department of Psychology;

Jeremy Ward, PhD, Middlebury College, Biology Department; and Shane Lamos, PhD, Saint Michael's College, Chemistry Department. The panel spoke one at a time and outlined what has worked for them and what they hope to achieve in the future.

The attendees then split into smaller groups for an informal workshop to develop Institution-Specific approaches to increasing the integration of research and teaching.

After a delicious lunch, Dr. Bert Holmes provided a brief overview of NSF programs of interest to faculty at undergraduate institutions as well as "The 15 Do's and Don'ts for Proposal Writing". Some of his tips included caring about the project, having measurable goals and objectives, and using good management skills. His talk was again met with much interest and enthusiasm. Following the overview was a lively question and answer period that concluded the program. All participants enjoyed the program and VGN would like to thank Middlebury College BPI Coordinator, Dr. Bob Cluss, and Grants Manager, Franci Farnsworth for their efforts in hosting the event.



# VERMONT GENETICS NETWORK 8TH ANNUAL RETREAT

## AUGUST 12, 2009

The Vermont Genetics Network (VGN) hosted its 8<sup>th</sup> Annual Retreat on Wednesday, August 12, 2009 at the DoubleTree Hotel in South Burlington. The day began with continental breakfast and a brief networking session.

At 9:00 a.m. Dr. Judith Van Houten, VGN Director, opened the program by welcoming all of the guests.

Next, three presentations by VGN funded faculty were given. The following faculty members from VGN's partner colleges spoke about their VGN funded research:

Gina Mireault, PhD – Johnson State College

“A Naturalistic Observation of Humor Perception and Creation in 3-6 Month Old Infants: Preliminary Descriptive Findings”

Ari Kirshenbaum, PhD – Saint Michael's College

“Response Disinhibition Evoked by Cholinergic Activation and Contextual Conditioning”

Mark Spritzer, PhD – Middlebury College

“The Impact of Hormones and Socialization on Neurogenesis and Memory in Adult Male Rats”

After a short break, Dr. Van Houten introduced the guest speaker, David Asai, PhD, Director of Precollege & Undergraduate Science Education, Howard Hughes Medical Institute. He spoke on “Peripatetic Wanderings: Dynein and Me”.

All of the presentations were very well received.

During lunch, the Baccalaureate Partner Institutions (BPI) Coordinators met to discuss their roles with VGN for the next year and to welcome the two new BPI Coordinators:

Natalie Coe, PhD, Green Mountain College and Alan Giese, PhD, Lyndon State College.

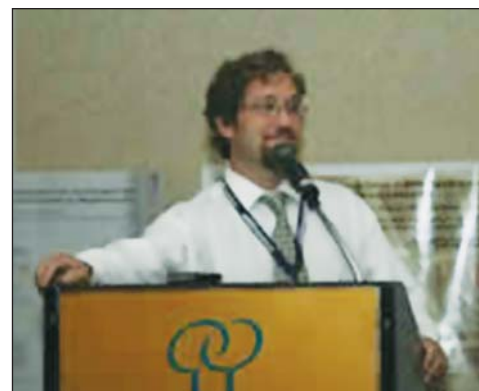
Following the buffet lunch, Nathan Besio, VGN Business Manager, held a meeting for Business and Grant Managers from each of the BPI Institutions. The group reviewed frequently asked questions concerning managing subcontracts and then finished with Q&A session.

While the Business Managers were meeting, other attendees networked and visited the posters that were presented by the BPI faculty, UVM Use of Facilities awardees and UVM graduate students who received VGN funding last year. There were 30 posters presented in multiple disciplines.

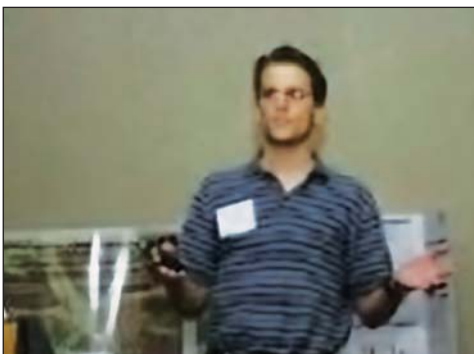
Dr. Van Houten closed the retreat by thanking Dr. Asai for traveling to Vermont to speak at the retreat. She also thanked the other faculty members and graduate students who presented posters and gave presentations about their VGN research.



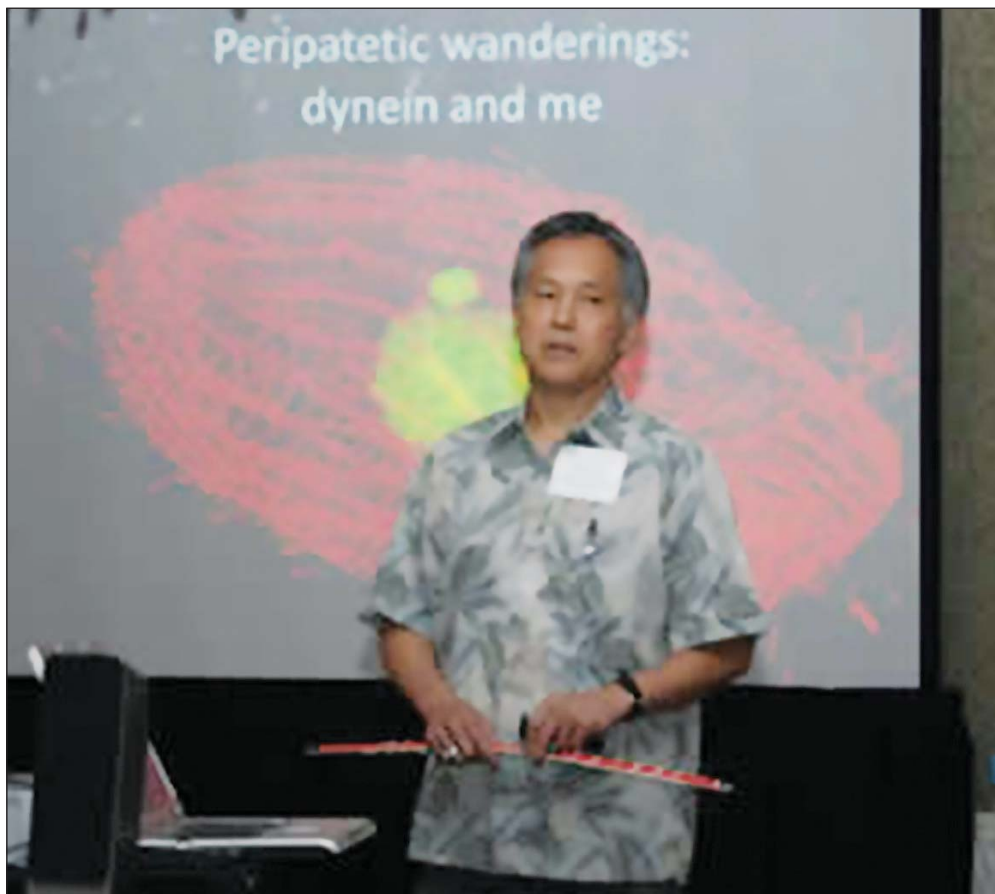
Dr. Gina Mireault, Johnson State College



Dr. Ari Kirshenbaum, Saint Michael's College



Dr. Mark Spritzer, Middlebury College



Dr. David Asai, Guest Speaker, Howard Hughes Medical Institute

## VERMONT GENETICS NETWORK MICROARRAY FACILITY EXPANDS ITS REGIONAL NETWORK

By Tim Hunter and Scott Tighe

This past year the Microarray Facility expanded its statewide network to include institutions in the Northeast region including Maine Medical Center Research Institute in Scarborough, ME and the Trudeau Institute in Saranac Lake, NY. While attending an open house at the Maine Medical Center Research Institute in December 2008, investigators from two COBRE centers expressed the need to access global gene expression profiling services that do not currently exist locally. Verbal agreements were made between MMCRI and UVM to share their distributed unique strengths to enhance the science capabilities at both sites, especially since both are funded by NCRR (National Center for Research Resources). The microarray facility has completed six projects from Maine for investigators in the Vascular Biology and Stem and Progenitor Cell Biology Centers of Biomedical Research Excellence. Similarly, researchers from the Trudeau Institute routinely attend our Microarray, DNA, and Flow Cytometry Open House held in June and inquired about microarray services and supporting protocols to isolate RNA from FACS sorted cell population from immune cells. After several protocols exchanges and experimental design meetings, samples were submitted and analyzed successfully.

As a result of developing regional networking with external labs, a new approach was required using PolyCom teleconferencing to facilitate experiment design meetings between the Microarray staff, Bioinformatic staff, and others regionally in the network. The IT aspects of these teleconferences were streamlined by Bryan Fleming, IT Support Specialist for VGN. These meetings are an important aspect of generating a good clear plan both from a laboratory and bioinformatics design stand point. Projects that have foregone these design meetings have often found shortcomings during data analysis; it is the goal of both VGN facilities to generate only high-quality data.

The Microarray facility staff have also investigated regionally what services or technologies that are not offered locally, but may be available regionally and of interest to its user base. In response to investigators request for performing protein array analysis, the staff has borrowed a GenePix 4000B dual-colored scanner from our Dartmouth neighbors. It is currently being used by faculty from the OB/GYN department to scan slide-based protein arrays. The scanner is located in Health Sciences Research Facility Room 307 and is currently available as a user driven instrument for a limited time period. Efforts to secure funding for this technology in the microarray facility are being pursued.

## TECHNICAL UPDATES FROM THE VGN MICROARRAY FACILITY: FACILITY RESEARCH PROJECT STUDIES THE AFFECTS OF RNA DEGRADATION ON MICROARRAY DATA

By Tim Hunter and Scott Tighe

The Microarray Core Facility continues to support research for investigators both by providing services to individual research laboratories for the University of Vermont and its statewide network as well as by playing a central role in introducing emerging technologies. This past year was the most productive for the facility by completing 29 projects for 23 investigators from five different institutions.

This past year, the facility staff completed a facility research study investigating the optimal target preparation approach when working with small recovery, compromised RNA targets. This study became critical as more investigators began working with LCM (laser capture microdissection), FACS (sorted cells), and micro tissues samples that produce small amounts of RNA target which exhibit some level of RNA degradation. Although analysis of degraded RNA is not suggested as a routine for an investigator or the facility, it is recognized that some special situations occur that require the use of compromised RNA. The study included a brain reference RNA that had been artificially degraded to four different levels and processed for microarray using five different amplification protocols.

Amplification protocols included the standard Affymetrix-Eberwine method, NuGEN Ovation, FFPE, and Pico methods that use chimeric DNA-RNA primers, and the AmpTec GmbH method that use a unique

trinucleotide primer. These amplified products were then hybridized to three types of Affymetrix GeneChips including 3' IVT arrays, Gene 1.0 ST arrays, and Exon 1.0 ST arrays.

This study found that when employing a certain target preparation approach, specifically the NuGEN Pico, it could circumvent issues associated with slightly degraded RNA and generate reproducible, valid results. However as RNA became severely degraded, the resulting microarray data generated misleading results due to both false positive and false negative signals.

The results of these data have allowed both the VGN Microarray Facility and Bioinformatics Facility to understand the tolerances of various amplification methods when applied to degraded RNA and to develop new guidelines for processing samples that have unavoidable RNA degradation such as that recovered from formalin-fixed paraffin-embedded tissues. These data have been presented both verbally and as a poster at several meetings, including the Advances in Microarray Technology (AMT) meeting in Stockholm, Sweden, the Northeast Regional IDeA meeting in New Hampshire, the UVM DNA Analysis Facility educational seminar series, and at the Association of Biomolecular Research Facilities (ABRF) in Memphis, Tennessee.

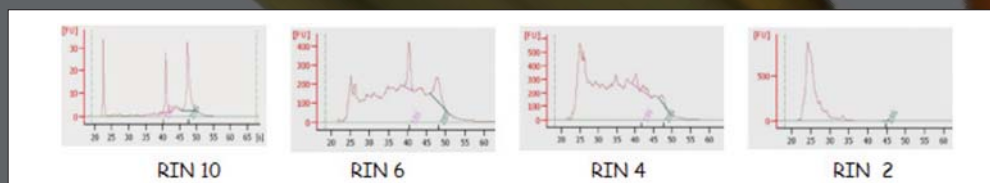


Figure 1. RNA assessment profiles of RNA used in the study. RIN 10 represents good RNA while RIN2 represents degraded RNA

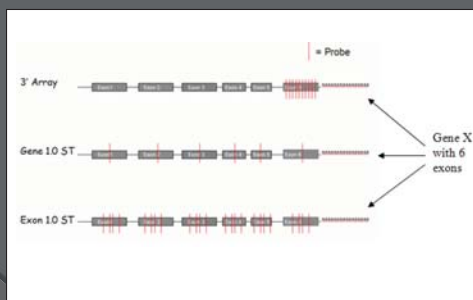


Figure 2: Comparison of probe design of Affymetrix GeneChips used in the study. Gene X is represented in 3 rows to the left and is composed of a horizontal arrangement of 6 Exons. Each row represents a type of GeneChip design and illustrates where the probes (in red) on the Affymetrix microarray target the gene.

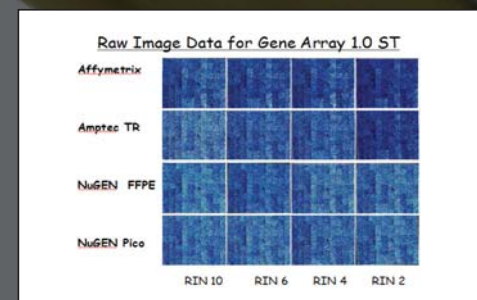


Figure 3: Microarray images from Gene 1.0 ST array data showing stable signal intensity across RIN Values for the FFPE and PICO methods. However, reduced signals were observed for the RIN 2 AmpTec TR and standard Affymetrix method indicating a negative affect caused by RNA degradation.



## THE LITTLE SKATE GENOME COLLABORATIVE PROJECT



Little skate (*Raja erinacea*)

The Bioinformatics Cores of five northeastern states, VT, NH, ME, DE and RI, have joined to form the North East Bioinformatics Collaborative (NEBC). The NEBC was created as part of a pilot project under the North East Cyberinfrastructure Consortium (NECC). This consortium of researchers, from the same five states, has worked to build high-speed fiber networks and a shared data center to support collaborative research across the region. Members of the NECC have recently been awarded funding from collaborative proposals to both the NSF and the NIH to begin building these networks and the data center.

Under the same funding, the NEBC will undertake a large-scale collaborative

research project to sequence and annotate the whole little skate genome. This collaborative approach will integrate resources and expertise across the NECC.

The project builds upon the research of Dr. Carolyn Mattingly, Mount Desert Island Biological Laboratory (MDIBL). The collaborative process will include preparation of samples from MDIBL, sequencing at the University of Delaware (UD) DNA Sequencing & Genotyping Center using an Illumina Genome Analyzer, transfer and storage of sequence data at the UD Shared Data Center and sequence assembly through the VGN Bioinformatics Core. Sequence annotation will be ongoing using the PIR integrated bioinformatics resource

and annotation pipeline at the University of Delaware. Members of the NEBC from each of the five NECC states will work closely together throughout the project.

A collaborative annotation conference will be coordinated MDIBL and the PIR resource at UD. These conferences will focus initially on training students and junior investigators to work with and annotate genomic sequence and become increasingly focused on the annotation of the little skate genomic sequence as the depth of sequence data increases. All sequences will be made publicly available via submission to the NIH's National Center for Biotechnology Information, integration with environmental health data in MDIBL's publicly available Comparative Toxicogenomics Database and for computational analysis via the University of Delaware Data Center.

This project will make an important impact on the biomedical research community while also providing a model for novel collaborative approaches to next generation sequencing of alternative organisms. The project will directly enhance the value of existing NIH and NSF supported programs and infrastructure by: maximizing collaborative use of specialized resources and expertise; demonstrating feasibility of sharing resources and establishing virtual data centers; and training a new generation of students and faculty in working with and extracting meaning from genomic data.

## VGN GRADUATE STUDENT PROFESSIONAL DEVELOPMENT

This year the VGN Graduate Student Professional Development Program offered two forums for the VGN supported graduate students. These meetings are required for VGN supported graduate students but are open to all science graduate students at UVM.

This year we offered our second post-doctoral panel with Sarah Hale PhD, Jeralyn Haraldsen PhD, Craig Yendrek PhD and Jeremy Steinbacher PhD. These UVM postdoctoral fellows gave us their background, told us how they found their current positions and answered questions from the graduate student attendees. The focus of the questions was how to find available post-doctoral positions and what issues to consider when deciding on a position. All forums are informal

and allow discussion of many student issues.

We also presented a discussion with Heather Kendal PhD, Karen Spach PhD and Janet Murray PhD on careers in science writing and other non-traditional career choices. Although most of the VGN supported graduate students plan on pursuing careers in academia or industry, they enjoyed hearing about the other types of career paths that are available.

This year, we are planning to have discussions on Research and Entrepreneurship, Science Writing for Graduate Students and we are hoping to host a screening of the film entitled "Naturally Obsessed: The Making of a Scientist". This is a one hour documentary by Richard Rifkind and Carole Rifkind (A ParnassusWorks Film).

<http://naturallyobsessed.com/blog/press/>

Mixing humor with heartbreak, the film tells a profoundly real yet intensely dramatic story about life in a molecular biology lab. "I want the viewer to stand in the shoes of a scientist at work in a lab, glimpse the world of research as it really is, and understand what it takes to fill an ample pipeline of future scientists" says scientist turned filmmaker, Sloan-Kettering Institute Chairman Emeritus, Richard Rifkind.

For more information on this documentary, go to <http://naturallyobsessed.com/>. Notification of the screening date will be broadly distributed.

## IT TAKES A VILLAGE TO DEVELOP PROTEOMICS IN VERMONT

By Bin Deng, Dwight E. Matthews and Bryan A. Ballif

The UVM/VGN Proteomics Core Facility is now in its third year. During this time, the facility has had great success in providing service and in educating researchers in higher education institutions about proteomics technology. In addition, facility supported publications and grant proposals are on the rise.

### In summary:

- The facility completed analysis of more than 3000 samples from UVM, VGN Baccalaureate Partner Institutions (BPI), and other institutions.
- More than 40 principal investigators and their groups submitted samples for proteomics measurements.
- Ten papers were published in peer-reviewed professional journals, and additional manuscripts have been submitted.
- The facility has provided supporting data and support letters for many investigator grant proposals; 16 of them have been funded by the NIH, NSF and other extramural funding agencies.
- VGN proteomic data was used in more than 50 oral and poster presentations given by the Proteomic Facility staff and users of facility services.
- The facility conducted an annual open house (seminar-based) which attracted researchers from UVM, VGN Baccalaureate Partner Institutions, and other institutions. Proteomics specialists from mass spectrometry vendors (such as Shimadzu, Thermo-Fisher, and EMD), facility staff and other facility users gathered to present and discuss their data and products, providing an opportunity and network and to strengthen communication.
- The facility has also opened its doors for numerous tours for high school students.
- The facility has developed a reasonable fee structure for samples (effective since January 20, 2009); on-line consultation sign-ups and on-line sample submission for users are functioning well.
- A regional collaboration for using the LTQ-orbitrap and SELDI-TOF mass spectrometers has been set up between VGN Proteomics Facility and the Maine



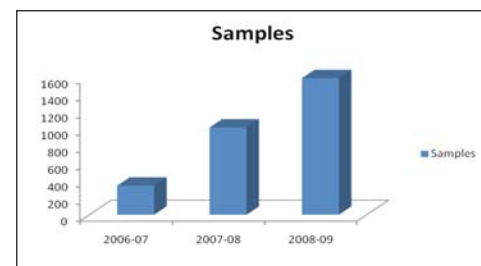
High school students from Bellows Free Academy at St. Albans, VT, visit the VGN Proteomics Facility

Institute for Human Genetics & Health.

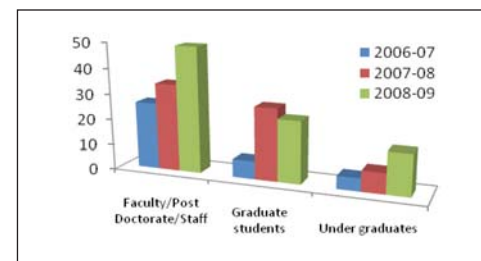
- The Proteomics Outreach Module finished a very productive beta testing here at UVM, and we will be taking the course to Saint Michael's College for the 2009 fall semester (2009).

With an eye to the future, we understand that it will still take a village to develop proteomics technology as open dialogue between the users and the facility personnel will enable even more improvements in proteomic analysis from the narrow, targeted analyses to the more global analyses contributing to the fields of systems biology and systems medicine. At this scale, the facility will begin assisting users in large-scale quantitative proteomics analyses employing stable isotope methodology (SILAC, TMT, iTRAQ, AQUA) on more targeted approaches, non-standard post-translation modifications are now being analyzed including protein glycosylation. We are also establishing methods to make mass measurements of small intact proteins by ESI LC-MS/MS (top-down) and off-line protein and peptide fractionation for complex mixtures. We expect an increase in investigators who will learn about and collaborate with us to conduct research projects; we will continue

working hard to meet their needs. Last year we reported several proteomics success stories in the VGN newsletter, look for more in the future, perhaps featuring you!



The VGN Proteomics Facility Shows a Strong Increase in the Number of Samples Analyzed.



VGN Proteomics Facility User Base Development



## THE VGN OUTREACH CORE

### What is VGN Outreach?

The VGN Outreach Core provides lecture and laboratory modules in bioinformatics, microarray and proteomics that can be incorporated into curriculum at the Baccalaureate Partner Institutions and other colleges. We bring with us whatever equipment or supplies are necessary for the modules and tailor the module to the facilities and backgrounds of the students. We leave behind the equipment that is necessary for the colleges to continue using the module in their future courses. These modules increase the skills of undergraduate science students within the state and help them in their future scientific career development.

All outreach manuals, presentations and other materials are available online from the VGN website. To encourage the incorporation of the modules and other curricular materials into biomedical science education at the colleges we serve, we leave teaching materials, supplies and laboratory equipment to enable the faculty member to continue to use the module in classes. In addition, the Outreach staff continue to work with college faculty to update materials, replenish supplies and provide consultations for years following the initial offerings.

### What are the Modules delivered?

- **Bioinformatics:** This module is an introduction to bioinformatics concepts and the primary bioinformatics, structural biology and chemistry databases. Two staff members deliver this module that enables students to access and analyze sequence and structure data, create and edit images of molecules, and present results in several formats. The course is designed as a four session online tutorial with exercises and independent projects integrated into the course.
- **Beta Test UVM Spring 2009**
- **Proteomics:** The module is presented in seven weekly lab sessions with two or three outreach team members at the sessions. It consists of three wet laboratories where students/faculty isolate total protein and conduct 2D-gel analysis. Students use Prodigy SameSpot software to compare gel images, then isolate gel spots and trypsinize the isolated proteins. The samples are then sent to the UVM proteomics core for analysis; students visit

the Proteomics Core facility at UVM, help with secondary analysis of their data and further investigate possible biological implications, generate presentations and reports.

As the impact of the Outreach Core grows, more Vermont undergraduates gain experience with cutting-edge technology.

The Outreach Core has been very successful over the last four years in delivering curricular modules, encouraging faculty and student research, and creating sustainable change in the biomedical education of students in Vermont. A total of 273 undergraduate students have experienced our outreach modules in the first four years of the current INBRE award.

### Microarray Modules:

- Developed during the BRIN granting period), the microarray module has been delivered to five new colleges in the last four years.
- In the past four years there were 13 total deliveries of this module to eight different colleges and 134 students.
- Seven out of eight colleges have repeated the microarray module at least once. After the first delivery, the course instructor becomes the primary instructor with one outreach team member present for support.
- To date four out of eight sites incorporated unique experiments. Faculty members are encouraged to design unique experiments; this flexibility allows faculty to optimize the program for their curriculum and develops their ownership of the course thereby increasing the likelihood of sustainable integration of this technology.
- Four out of eight colleges have incorporated the microarray module into their curriculum as part of an existing course or an independent mini-course.

### Bioinformatics at SMC Fall 2008

- Introduction to Data Mining was developed and beta-tested in 2006 and began outreach delivery in 2007.
- The bioinformatics tutorial has been ported to a web-based content management system, Moodle; it is updated each semester with new information, links and databases
- To date, there have been six total deliveries of this module to three different colleges (NU, SMC and GMC) and 129 students.
- Two out of three colleges (SMC and GMC) have incorporated this module into their curriculum as part of an existing course or an independent mini-course. The third college (NU) has delivered parts of the module in different courses demonstrating the flexibility in integrating the individual tools offered in the module.

### Proteomics Modules:

- The proteomics outreach module was developed and beta-tested in the Spring of 2009 at UVM.
- Bryan Ballif joined the outreach team for development and delivery of this module.

### What's Next?

This is an exciting year for the Vermont Genetics Network Outreach Core. We begin our first outreach delivery of our new Proteomics Module to Saint Michael's College. We will be working with Associate Professor Alayne Schroll in the Department of Chemistry. We have three more colleges tentatively scheduled for 2010! We are working with Dr. David Blank to bring the Bioinformatics Module to students at Castleton State College and supporting delivery of bioinformatics to two other colleges where it has previously been taught. Delivery of the Microarray Module is scheduled for three Vermont colleges in the 2009-2010 academic year.

We are working with Dr. Stephanie Richards at Bates College to bring the VGN Microarray Module to the Bates campus in collaboration with the Maine State INBRE. In the next phase of INBRE, we plan to expand outreach to more Vermont colleges including The Community College of Vermont with 12 teaching sites statewide!



## VGN SUPPORT FOR GENOME-WIDE EXPRESSION EXPERIMENTS

By Julie Dragon



**P**amela Lescault, a graduate student and Mariana Matrajt an Assistant Professor of Microbiology & Molecular Genetics, recently completed VGN-supported

research looking at gene expression in *Toxoplasma gondii*, the organism responsible for the parasitic disease (Toxoplasmosis) often associated with exposure to parasite-contaminated cat litter during pregnancy. Their research required development of new methods and software by the VGN-supported Molecular Bioinformatics Shared Resource, which allowed them to quantify mixtures of cellular states and subsequently obtain a new understanding of developmental stages during *T. gondii* differentiation. These results are soon to be submitted for publication to Molecular Microbiology. As a result of their success, Pamela decided to pursue graduate studies in

bioinformatics and is now a Ph.D. candidate in MMG working with Dr. Giselle Sholler and Dr. Jeffrey Bond on a childhood cancer, neuroblastoma. Her thesis work focuses on the dynamics of drug action through design and analysis of microarray time series.

**V**GN welcomes Dr. Julie Dragon to the staff. Julie received her Ph.D. from UVM's Plant Biology Department in 2006 and recently completed two years of postdoctoral research in McGill University's Plant Science Department. Julie joined the VGN to provide microarray experiment design and analysis services. She supports analysis of whole transcript microarrays, a technology recently brought to Vermont by the VGN Microarray Facility. Whole transcript microarrays allow identification of differential splicing in addition to changes in expression levels. Julie also is the local expert on analysis of gene expression statistics in the

context of biological systems using Ingenuity Integrated Pathway Analysis resources. She is responsible for user-group support sessions designed to give investigators a weekly



opportunity to bring their microarray questions for a mixture of one-on-one support and group feedback. Julie and Jeff Bond of the Molecular Bioinformatics Shared Resource

are updating the gene expression analysis pipeline in order to better serve the microarray community. Lastly, Julie has been working with Rama Kocherlakota to roll out the Microarray Depot portion of the Biodesktop, which will support ordering microarray services as well as data delivery.



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