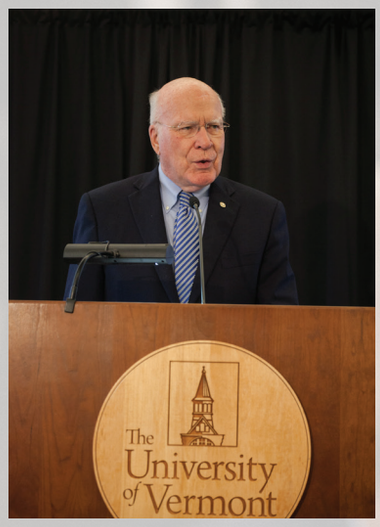
VERMONT GENETICS NETWORK

WINTER 2016

INSIDE

Loan (Lorraine) Dang
VGN Student Intern

Leahy, UVM and Vermont College Leaders Announce $17.8 Million NIH Grant to Vermont Genetics Network



Sen. Patrick Leahy, Senior Senator to the US Congress from Vermont, University of Vermont President Tom Sullivan, and representatives from seven Vermont colleges and universities gathered in Burlington June 12 for the announcement of the Vermont Genetics Network's (VGN) five-year $17.8 million grant from the National Institutes of Health (NIH) for cutting-edge biomedical research. The award comes from NIH's Institutional Development Award (IDeA) Networks of Biomedical Research Excellence (INBRE) program.

The Vermont Genetics Network is funded by NIH under the National Institute of General Medical Sciences. The program is intended to build human and physical infrastructure in Vermont for biomedical research that benefits Vermonters and patients worldwide. This is the third award granted to VGN in 15 years to help train the next generation of scientists, while ensuring that Vermont continues to attract world-class clinicians, researchers and medical professionals to develop and apply advanced medical practices.

As the lead institution of the Vermont NIH-INBRE, the University of Vermont provides funding to research faculty and students at seven baccalaureate partner institutions, including Saint Michael's College, Lyndon State College, Johnson State College, Norwich University, Castleton University, Green Mountain College, and Middlebury College. The university also partners with the Community College of Vermont and Landmark College to include a broader range of students in world class research opportunities.

Senator Leahy said, "I have long been impressed by the tireless dedication of biomedical researchers to build preventative strategies, therapies and cures for thousands of devastating diseases worldwide. Nearly every drug, vaccine and treatment we use today is grounded in years of biomedical research. These resources will help to ensure that the Vermont Genetics Network can continue to make critical investments in college lab classes, innovative research efforts, and Vermont's reputation as a leader in biomedical advancement."

Dr. Judith Van Houten, Director of the Vermont Genetics Network, said, "The Vermont Genetics Network could not compete for these significant funds if Senator Leahy had not put his support behind the funding for the NIH and for Programs like IDeA that funds VGN. VGN contributes to cutting edge infrastructure for biomedical research and workforce development across Vermont, so that quality of health care and STEM education are not determined by your zip code. Small rural states like Vermont need these resources."

Elizabeth Dolci Appointed VGN Program Coordinator

We are proud to announce that Dr. Elizabeth Dolci, PhD, of Johnson State College is our new Project Coordinator. Dr. Dolci joined the faculty at Johnson State College in 1992 after spending 15 years as a research scientist in cell biology at Yale University and the University of Vermont. She earned a PhD from the University of Michigan. She serves as the longest Chair of the Department of Environmental & Health Sciences at Johnson State College, an elected position. The culture of research at Johnson has been strengthened and promoted through her efforts has resulted in vibrant research programs year round.

Students who have been mentored by Dr. Dolci have presented their research at the Council of Undergraduate Research (CUR) annual Posters on the Hill, received outstanding student poster awards at the NE regional Geological Society of America, and presented posters at the National Conference for Undergraduate Research (NCUR). She has worked with VGN for many years and currently serves as the Chair of VGN's baccalaureate partner institution coordinators.

Reproductive Biology Expert Catherine Combelles Receives Grant For Studies Of Oocyte Development

Catherine Combelles, PhD, Associate Professor of Biology at Middlebury College is studying the effect of antioxidents on oocyte development. (An oocyte is the cell from which an egg develops.)

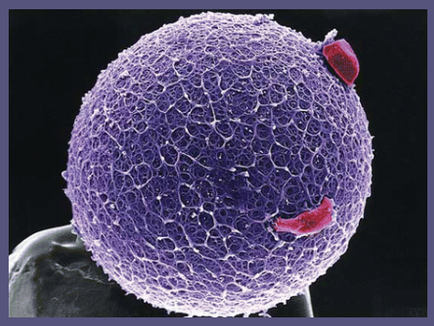
"The health of adults, neonates, and fetuses all depend upon normal development of the embryos and oocytes from which they arise. My laboratory is interested in (1) understanding what makes up a good quality oocyte as well as (2) identifying determinants of oocyte quality."

"Using a clinically relevant animal model, our current assessment centers on the oxidative stress status of bovine oocytes. Towards this goal, we investigate the oxidative stress systems that prevail in all of the compartments making up the ovarian follicle, thereby defining the milieu within which an oocyte is about to embark on the penultimate developmental process of oocyte maturation."

Her laboratory also focuses on designing novel culture conditions in order to support the development of optimal quality oocytes in vitro. Long-term application of her work includes the improvement of not only treatment strategies for human infertility but also reproductive efficiency in domestic species.

Collaborative projects involve the diagnostic evaluation of human oocytes that fail to mature normally, the cryopreservation of human immature oocytes, and the monitoring of antioxidants secreted by human embryos of different developmental competencies.

Catherine Combelles, PhD



Oocyte: a cell in an ovary that may undergo meiotic division to form an ovum.

Color-Enhanced Scanning Electron Micrograph of a Human Egg.
From Yorgos Nikas/Wellcome Trust.

In 2014, Dr. Combelles was awarded an R15 research grant through the National Institutes of Health's AREA (Academic Research Enhancement Award) program. This grant supports work to determine the effects of endocrine-disrupting compounds on the oocyte and the ovarian follicle, the structure that nurtures the developing oocyte. Because the health of adults, neonates, fetuses, and embryos all depend upon normal oocyte development, the findings will help to provide a foundation for improving not only female reproductive but also adult health. The grant funds research at Middlebury, the University of New Hampshire, and Emory University, including supplies and travel to conferences as well as Dr. Combelles 2015-16 academic leave. At least 15 undergraduates will be involved in this research over the next three years.

Dr. Combelles received a sabbatical grant from the U.S. Department of Agriculture's National Institute of Food and Agriculture to support her 2015-16 academic leave. The grant covers leave salary and expenses related to research at the French National Institute for Agricultural Research (INRA) in Toulouse, France. This grant will enable Dr. Combelles to acquire advanced metabolomic approaches for use in studies on the microenvironment of the developing follicle in cow ovaries.

Dr. Combelles previously received project award funds from VGN that helped develop her early research and continued her path to successful extramural funding opportunities.

Cow Milk May Contain Human Health Surprises

Sabrina Greenwood, PhD

“Delilah”

Thousands of proteins and peptides are present in milk, many with known bioactive properties. Human breast milk is an important source of these bioactive proteins and peptides for nursing infants, but cow’s milk also contains bioactive proteins and peptides, some of which affect not only milk-fed calves but also humans.

Dr. Sabrina Greenwood’s lab in UVM’s Department of Animal and Veterinary Sciences is investigating how to manipulate the profile and amount of these proteins in cow’s milk with the long term goal of enriching cow milk with beneficial proteins. One recent project included comparison of the skim milk protein profile (the proteome) produced by the two dominant dairy cattle breeds in the USA. They provided insight into what protein profiles of these different breeds when they are maintained under the same environmental and nutritional conditions. Elucidation of the protein profile was accomplished using a combination of enrichment and fractionation techniques, followed by Mass Spectrometry-based proteomic analysis.

The Greenwood lab has been working with Dr. Ying-Wai Lam and Julia Fields from the VGN Proteomics facility to characterize the milk protein profile produced from lactating dairy cattle, using Mass Spectrometry to identify over 900 milk proteins. ***The support of VGN has been integral for this research.*** The collaborative efforts between Dr. Greenwood and VGN‘s Proteomics Facility have led to the development of new methods for optimization of protein extraction and characterization of the low abundance proteins within the skim milk fraction of bovine milk.

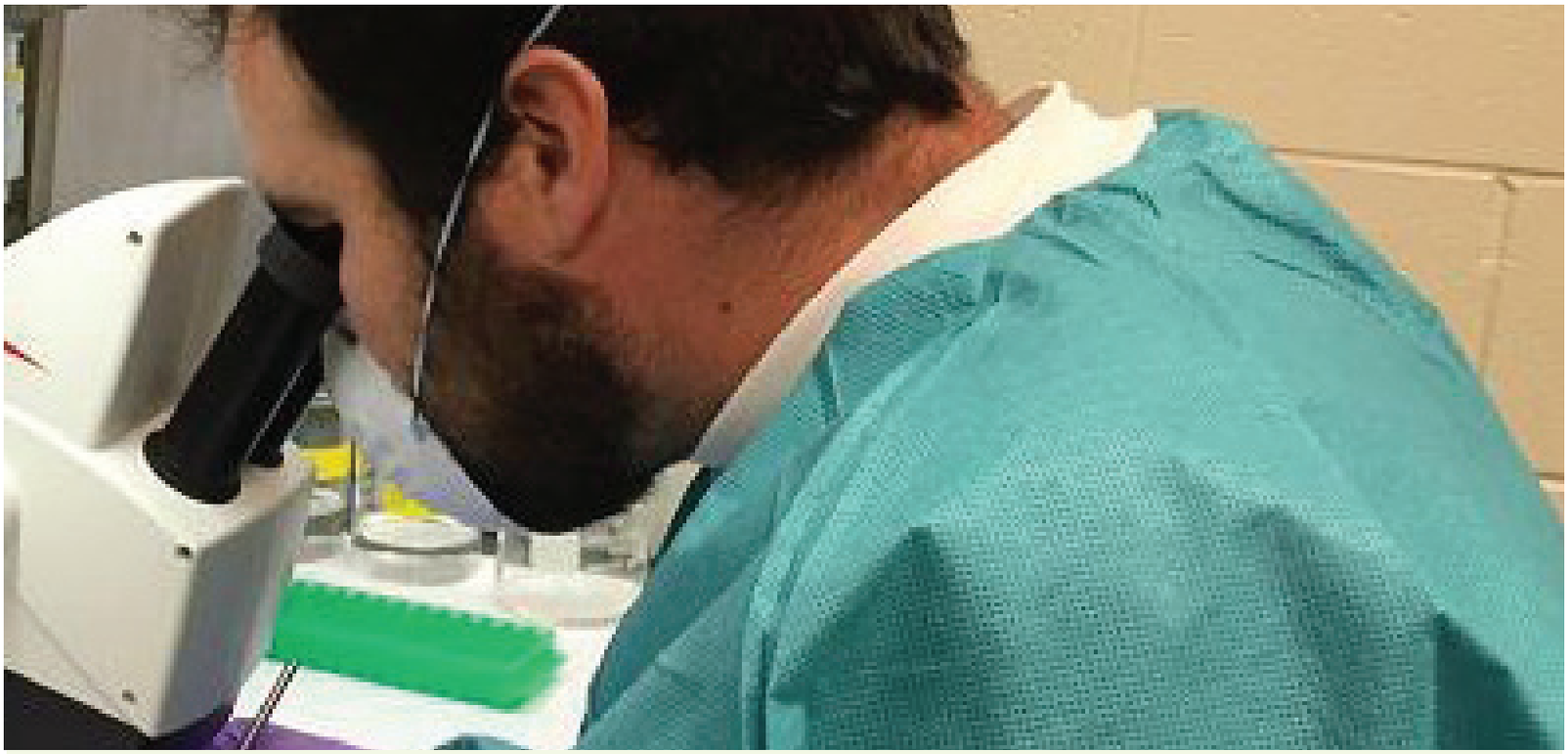
Researchers Dissect Ticks Sear

Dr. Alan Giese of Lyndon State College, a consortium partner of VGN, studies the Black-legged Tick (*Ixodes scapularis*). These ticks carry a spirochete bacterium (*Borrelia burgdorferi*) that is the causative agent of Lyme disease. Dr. Giese collects Black-legged Ticks from locations in Vermont with differing tick densities to examining patterns in the tick microbiome. The tick microbiome consists of all the bacteria and other microbes contained in the Black-legged Tick. These ticks can carry many microbes including *Borrelia* and patterns observed in the microbiomes of ticks from different areas could help us understand the spread of the tick, the spirochete, and lyme disease.

This faculty and undergraduate research collaboration has expanded dramatically. Prior to receiving funds from the VGN, Giese and a student were monitoring tick densities at five sites in Vermont. Technical and financial support available through VGN allowed Giese and his students to begin molecular based PCR (Polymerase Chain Reaction) testing of ticks for human pathogens, which resulted in conference presentations and a publication. Momentum generated by this early work has led to: an expansion of the monitoring program to twelve sites, >800 Black-legged Ticks tested for multiple human pathogens, collaborations with faculty at the University of Massachusetts, Amherst and the University of Vermont Medical School, ~200 tick microbiomes examined, and progress toward extensive sequencing of bacteria from ticks and dissected tick midguts.

Alan Giese, PhD and student Charlie Delany

Dr. Ralph Budd, Professor Medicine and Microbiology & Molecular Genetics at the University of Vermont, has served as a research mentor for Giese. “Working with Dr. Ralph Budd has greatly expanded the scope and the quality of my research. Through Dr. Budd I have been introduced to a range of experts who have improved the quality of my research in various ways, ranging from thought-provoking conversations to targeted technical training. Dr. Budd introduced me to Dr. Justin Radolf, and in the Radolf laboratory at the University of Connecticut I received training on microdissection of tick midguts. That work became a cornerstone of my research for the next nine months as I focused on a comparison of whole-tick vs midgut microbiome. Half of this research is being done through a VGN pilot grant, and half is being conducted through a direct collaboration with Dr. Budd. The former utilized a relatively less-expensive 16S-amplicon approach allowing larger sample sizes, while the latter utilizes shotgun sequencing and promises deeper



ching DNA for Clues to Disease

coverage. Due to cost, shotgun sequencing would not have happened without Dr. Budd's collaboration. Dr. Budd also introduced me to Dr. Tim Sellati, (Senior Research Fellow and Chair, Infectious Disease Department at Southern Research) and conversations with members of the Sellati lab have greatly improved the quality of my research plans. The possibility of collaborating with members of the Sellati lab on an external grant proposal is exciting. It is difficult to maintain a stand-alone research program when geographically isolated from colleagues. Dr. Budd's support has been pivotal in transcending geographical isolation and integrating my work into a network of like-minded researchers."

Giese's lab currently has seven undergraduate students working on tick-related projects. Together they have three manuscripts in preparation. Technical support available through VGN facilitated the molecular genetic training that led to PCR-based pathogen testing for *Borrellia burgdorferi*, the causative agent of tick-borne Lyme Disease, and a peer-reviewed publication. Funds from the VGN allowed Giese and his students to expand the scope of research to include microbiome analysis of ticks from three sites in Vermont and one in Massachusetts, comparison of the microbiome of three species of tick (*I. scapuaris, Amblyomma americanum, Dermacentor variabilis*), and comparison of whole ticks to dissected tick midguts.

Alan Giese, PhD

Dr. Giese's research has been featured in several local media outlets.

WNPR - Connecticut Public Radio
VPR - Vermont Public Radio
NIH - National Institute of Health

Dr. Ralph Budd is the Director of the Vermont Center for Immunobiology and Infectious Diseases. This COBRE combines the expertise of the UVM groups in Immunobiology, Microbiology, Infectious Diseases, and the Vermont Vaccine Trials Center to promote collaborative studies into the immune response to infectious agents, including viruses, bacteria and parasites, as well as studies of microbial pathogenesis and autoimmune disorders.

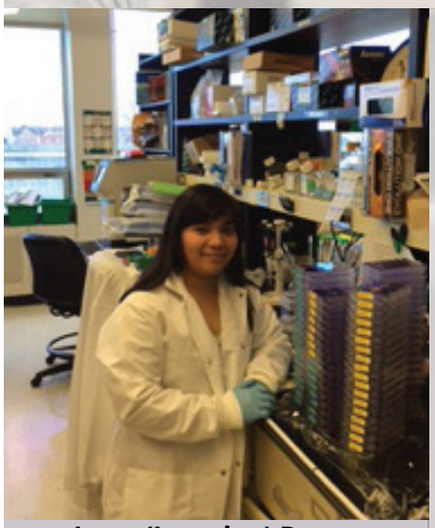
Johnson State College Students Awarded Outstanding Undergraduate Poster Award

Johnson State College students Heather Murphy and Shayna Bennett were awarded an Outstanding Undergraduate Poster award at the Geological Society of America Northeastern Section Meeting, held March 23-25, 2015 in Bretton Woods, NH. Presentations were evaluated and scored by 46 volunteer judges. Only nine students, the top 5% of 192 undergraduate poster presentations, were chosen as outstanding.

Their poster summarized their research into microbes living in a pond at the abandoned Vermont Asbestos Group mine in Lowell, Vt. Former VGN funded researcher Dr. Elizabeth Dolci, Professor and Chair of JSC's Department of Environmental & Health Sciences, mentored the students.

Heather and Shayna also presented their research in April 2015 at the National Conference for Undergraduate Research at Eastern Washington University, Spokane, WA and in June 2015 at the Annual Meeting of the American Society of Microbiology in New Orleans, LA.

Heather Murphy (left) and Shayna Bennett



Loan (Lorraine) Dang

Jamie Gay

VGN Summer At-Large Interns Conduct Biomedical Research

Community College of Vermont (CCV) undergraduate students competed for and were awarded VGN 2015 At-Large Summer Internships. Awardees Loan (Lorraine) Dang and Jamie Gay are pursuing their undergraduate degrees in Science at CCV.

Loan (Lorraine) Dang performed her summer research in Jason Botten's laboratory in the Department of Medicine-Immunobiology at the University of Vermont. Lorraine's research focused on identifying possible modifications to an arenavirus protein involved in defective interfering particle formation. Arenaviruses are RNA viruses that cause some severe human diseases including hemorrhagic fever and aseptic meningitis. This research will improve understanding of the basic biology of arenavirus replication and could provide new targets for the development of much needed antiviral therapies. Lorraine continues to do research in Dr. Botten's laboratory during the 2015-2016 academic year.

Jamie Gay conducted her research in Dr. Karen Glass's Laboratory at the Albany College of Pharmacy and Health Sciences. Her research examined the interaction between proteins that bind to and control DNA function. One group of these proteins, ATAD2 proteins, have been shown to have a role in uncontrolled growth in some aggressive cancers. Better understanding ATAD2b protein function could lead to the development of small molecule inhibitors and future therapeutics. Following her internship, Jamie was recruited by Dr. Glass to work in her laboratory.

Jamie and Lorraine will be presenting their research on April 13th, 2016, at the **VGN Career Day**.

Castleton University Student Accepted to American Society for Microbiology Research Fellowship Program

Christopher Villa

Christopher Villa, a 2015 graduate of Castleton University with a degree in biology, was accepted to the American Society for Microbiology Research Fellowship Program.

Christopher started his undergraduate student research in 2013 with an undergraduate internship from VGN under the mentorship of Dr. Preston Garcia, Assistant Professor of Microbiology at Castleton University. Christopher's focus was studying crosstalk of genes involved in secondary carbon metabolism in the soil bacteria *Sinohizobium meliloti*.

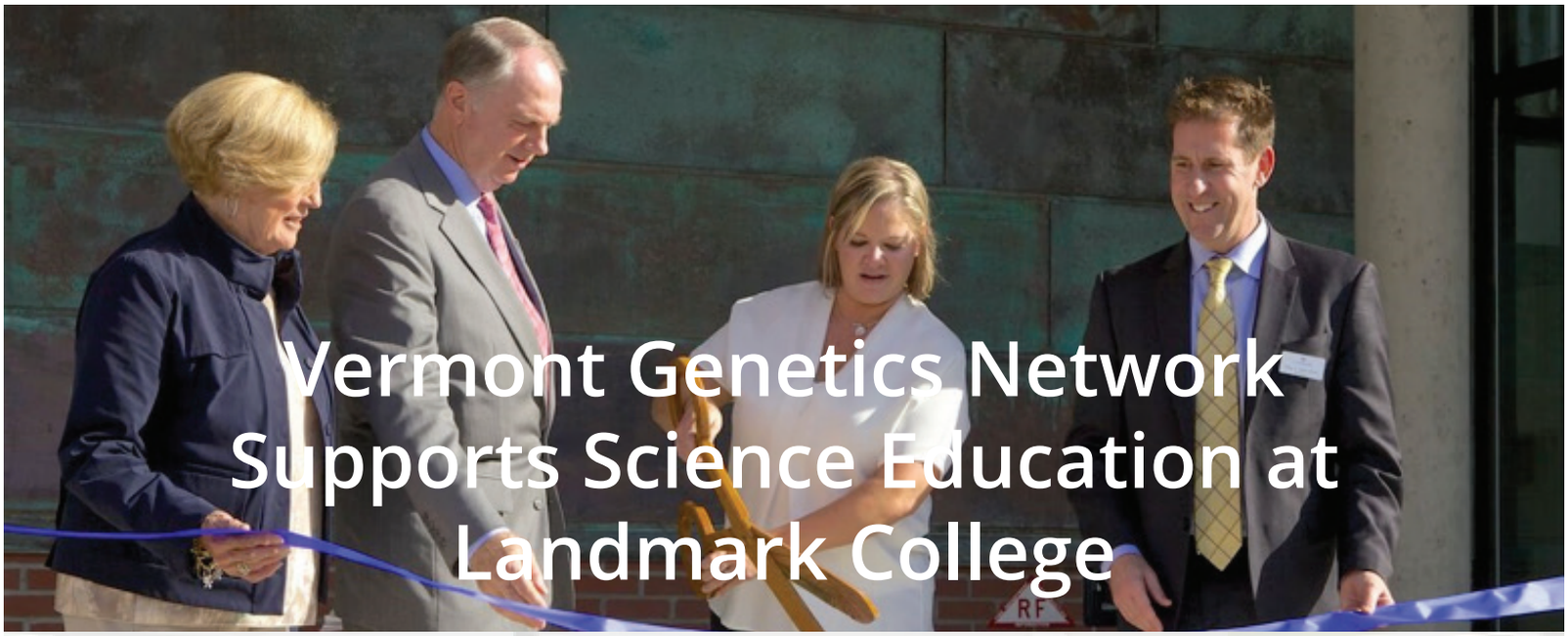
In February 2014 Christopher applied for an Undergraduate Research Fellowship from the American Society of Microbiology (ASM). He was one of 40 students in the United States awarded this fellowship. At the annual ASM meeting in May-June of 2015, Chris presented a poster on his original work.

Christopher is now a graduate student at the University of Vermont, pursuing a PhD in microbiology.

We are proud of Christopher's accomplishments and that he was supported as an undergraduate researcher at Castleton University with funds from Vermont INBRE.

Villa with President Sullivan (center) and Senator Leahy (right)

VGN Colleagues



Vermont Genetics Network Supports Science Education at Landmark College

(Left to Right): Nan Strauch (Trustee), Robert E. Lewis (Chair of Board of Trustees), Nicole Goodner MacFarlane '96 (alumna), and Peter A. Eden, PhD (Landmark College President)

Landmark College is the Vermont Genetics Network's newest outreach partner institution. The college, specializing in undergraduate education for learning disabled students, has strengthened its commitment to STEM education with the building of the Nicole Goodner MacFarlane Science, Technology and Innovation Center completed in the summer of 2015.

In the spring of 2015, the VGN Professional Development and Education Core worked with faculty members Abigail Littlefield, Andrew Stein and Kim Coleman at Landmark College to integrate a hands-on science experiment into their curriculum and help assess the possible laboratory needs in the ongoing building construction.

The partnership between Landmark College and VGN occurred at an opportune time. VGN was recently awarded a 5 year, 17.8 million-dollar award from the National Institute of General Medical Sciences within the National Institutes of Health. This award enabled VGN to contribute over $80,000 in equipment and supplies to enhance the laboratory and meeting spaces in the MacFarlane Center and enrich the scientific programs at Landmark.

"The support and equipment that the Vermont Genetics Network has provided our students has been priceless."

Dr. Abigal Littlefield

Dr. Abigail Littlefield, Chair of the Natural Sciences Department at Landmark commented on the new relationship forged between VGN with Landmark College.

"The support and equipment that the Vermont Genetics Network has provided our students has been priceless. The staff came into our labs, bringing the equipment and supplies as well as their expertise and taught not only our students but also our faculty. The VGN staff is excellent; they are true teachers; they know just how to impart excitement for the topic, while at the same time making complex scientific concepts understandable to all different learners.

"VGN donated to Landmark a vast array of high-end equipment to help us set up our new laboratories. Our labs are now sporting the cutting edge equipment needed to provide the best science education for Landmark students. Landmark College is very grateful for all the support VGN has provided and continues to provide our students!"

The new building houses the Mathematics and Computer Science Department, the Natural Sciences Department, and the Landmark College Institute for Research and Training. The MacFarlane Center is equipped with classrooms, meeting space and laboratories to meet the needs of STEM students and faculty.

FROM THE DIRECTOR

We recently submitted a request for applications to faculty members and students for our next round of funding that will begin in June. We provide faculty $75,000 for project awards and $25,000 for pilot awards. Students have the opportunity to work at their home institutions or other outreach partners within Vermont or our Northeast INBRE colleges. We received 13 project and 12 pilot applications from faculty and student applications are still coming in. We are looking forward to reading the proposals and funding new and exciting research!

Good luck to all of the applicants!

J. Van Houten

Judith Van Houten, PhD
Director, Vermont Genetics Network
University Distinguished Professor
University of Vermont

Internal Steering Committee

BPI Members

Robert Cluss, PhD
Professor of Chemistry & Biochemistry
Middlebury College

Natalie Coe, PhD
Associate Professor of Biology
Green Mountain College

Elizabeth Dolci, PhD
Professor and Chair of Environmental & Health Sciences
Johnson State College

Alan Giese, PhD
Associate Professor of Natural Sciences
Lyndon State College

Tim Grover, PhD
Professor and Chair of Natural Sciences
Castleton University

Mark Lubkowitz, PhD
Professor of Biology
Saint Michael's College

Scott Page, PhD
Associate Professor of Biology
Norwich University

UVM Faculty

Ralph Budd, MD
Professor of Medicine
Director, Immunobiology Program

Christopher Francklyn, PhD
Professor of Biochemistry
Adjunct Professor, Microbiology & Molecular Genetics

Charles Irvin, PhD
Professor of Medicine, Pulmonary Medicine

Susan Wallace, PhD
Professor and Chair, Microbiology & Molecular Genetics

Stephen Higgins, PhD
Professor and Vice Chair, Psychiatry

Administration

Joseph Byrne, PhD
Assoc. VP for Academic Affairs (Norwich)

Richard Galbraith, MD, PhD
VP for Research (UVM)

Thomas Vogelmann, PhD
Dean, College of Agriculture and Life Sciences (UVM)

External Advisory Committee

Chair, Carol Newlon, PhD
Emeritus Professor
Department of Microbiology & Molecular Genetics
Rutgers New Jersey Medical School

Peter Bruns, PhD
Professor of Genetics Emeritus, Cornell University, and Vice President retired, Howard Hughes Medical Institute (HHMI)

Graham Walker, PhD
American Cancer Society Professor, HHMI Professor
Department of Biology
Massachusetts Institute of Technology (MIT)

George Witman, PhD
Professor, Cell and Developmental Biology
University of MA Medical School

About VGN

VGN is designed to provide the equipment and technology necessary to enhance the competitiveness for national funding for genetics research and to enhance and continue to build a culture of research throughout the state of Vermont. We are committed to future generations of research scientists therefore we support student and faculty research at Baccalaureate Partner Institutions (BPIs). Our goal is to bring about sustainable changes in how we in Vermont carry out research and educate our next generation of scientists and doctors.

VGN is funded by the National Institute of General Medical Sciences as part of the **National Institutes of Health initiative IDeA Networks of Biomedical Research Excellence (INBRE)** under award number P20-GM103449.

Vermont Genetics Network
University of Vermont
120A Marsh Life Science Building
Burlington, VT 05405

VERMONT GENETICS NETWORK

CURRENT TITLES OF OUR FACULTY'S FUNDED RESEARCH

"High-Speed 30 Multiphoton Fluorescence Imaging with Temporal Focusing Microscopy"

"Genetic analysis of neurotransmitter release in C. elegans"

"Metagenomic Assessment of the Microbiome of the Black-legged Tick"

"Ecological drivers of Borrelia burgdorferi infection in Ixodes scapularis"

"Immune genetic diversity and infectious disease in wild Vermont bobcats"

"Improving causal gene prediction from GWAS"

"Genome-wide Association for Ethanol Sensitivity in the DO Mouse Population"

"Thermal Decomposition of Biomass: Molecular Pathways for Sulfur Chemistry"

"Comparing behavioral strategies for reducing stress in adults"

The VGN links resources at the University of Vermont to its partner institutions, which include:

Castleton University
Green Mountain College
Johnson State College
Lyndon State College
Middlebury College
Norwich University
Saint Michael's College
Community College of Vermont*
Landmark College*

NIH reminds us that "IDeA Investigators being funded through one of the IDeA initiatives are expected to apply for and receive independent research funding." VGN's mission is to provide the resources for researchers in our partner institutions to develop their research and submit competitive proposals to support their research into the future.

* Outreach Partners