

VERMONT BIOMEDICAL RESEARCH NETWORK (VBRN)
UNDERGRADUATE STUDENT SUMMER RESEARCH SUPPORT 2023

Application due by web submission on February 21, 2023, by 4:00 PM EST

Student Summer Research Support applications are submitted online via the VBRN website (<https://vbrn.org/vbrn-awards/>). Students will need to create an account to apply. If a new account is being created, a confirmation email will be sent before the student can proceed with the application. Please note that the confirmation email will only be sent during regular VBRN business hours, which are Monday-Friday from 8:30AM-4:30PM. Students who have been previously funded by VBRN or who have applied for VBRN funding can click a link [on the application site](#) to have their login information emailed to them.

The VBRN **2023 Undergraduate Summer Research Support** is for students who wish to work outside their home institution (see list below). Women, minorities, veterans, and individuals with disabilities are strongly encouraged to apply. Students must be enrolled as undergraduates in Fall 2023.

Undergraduate students from the following programs/institutions are eligible to apply:

- Castleton University
- Champlain College
- Community College of Vermont (CCV)
- Landmark College
- Middlebury College
- Northern Vermont University
- Norwich University
- Saint Michael's College
- Northeast Regional INBRE Programs (DE-INBRE, ME-INBRE, NH-INBRE, RI-INBRE)
- Biomedical Sciences Career Program (BSCP)*

*Applications received through the BSCP Program are welcome from all states in the NE area, but preference will be given to applications from VT, NH, ME, RI, and DE.

Research position dates and locations

The program runs from Thursday, June 1 to Friday, August 4, 2023.

Student research opportunities are available at the following locations as described at the end of this document.

- Bia Diagnostics (Colchester, VT)**
- Vernal Biosciences (Colchester, VT)**
- Prolytix (Colchester, VT)**
- University of Vermont (Burlington, VT)**

**Students placed at these locations will be offered VBRN-funded dormitory housing (single room in a shared suite) at the University of Vermont (Burlington, VT). Public transportation is available, or the student will need access to a personal vehicle for the internship period.

Research Position Benefits

The students will be employees of Norwich University and will receive an estimated gross salary of \$5,400 minus any applicable taxes. The lab in which the student is placed will also receive an additional \$1,000 to use for lab supplies or conference travel for the individual. Housing provisions are as described above.

Interested applicants must notify the appropriate VBRN Research Coordinator/Contact (listed below) of their intent to apply:

Home Institution/Program	BPI Coordinator/ Contact	Email
Castleton University	Dr. Andrew Vermilyea	andrew.vermilyea@castleton.edu
Northern Vermont University (Johnson and Lyndon campuses)	Dr. Greg Petrics	greg.petricks@northernvermont.edu
Norwich University	Dr. Darlene Olsen	dolsen1@norwich.edu
Middlebury University	Dr. Rick Bunt	rcluss@middlebury.edu
St. Michael's College	Dr. Mark Lubkowitz	mlubkowitz@smcvt.edu
Community College of Vermont (all campuses)	Ryan Joy	ryan.joy@ccv.edu
Landmark College	Jan Coplan	JanCoplan@landmark.edu
Champlain College	Dr. Scott Stevens	stevens@champlain.edu
NE Regional INBRE Institutions (DE, ME, NH, RI)	VBRN Staff	vbrn@uvm.edu
Biomedical Sciences Career Program (BSCP)	VBRN Staff	vbrn@uvm.edu

The online application consists of the following:

1. A statement of purpose (up to 500 words) that addresses:
 - a. Student's interest in a biomedical research opportunity
 - b. Student's future career plans
 - c. Description of your prior research experience, including didactic lab coursework. Students who have completed a year or two of their undergraduate degree program and have completed some of their lab courses will be given preference for acceptance over applicants with no previous lab experience.
 - d. Your top three research locations listed below ranked in order of interest (1=first choice, 2=second choice, 3=third choice)
2. Resume/Curriculum vitae (highlighting any prior research experience, if applicable)
3. Unofficial transcript(s)
4. Contact information (email address and phone number) for one faculty member who will provide a letter of recommendation. The faculty member will receive an email from VBRN with instructions for submitting the reference. The letter must be received by vbrn@uvm.edu by the application due date (February 21, 2023).

As part of the selection process, students will be required to have a conversation (in person or via telephone or videoconferencing) with their potential lab mentor before being offered a research position.

Obligations that come with funding:

- Students must be enrolled as undergraduates (at any institution) in Fall 2023.
- Students will work 37.5 hours a week conducting research from June 1-August 4, 2023.
- Lab supply/conference travel funds must be expended by August 31, 2023.
- Students will participate in time and effort reporting, and annual and long-term career tracking, as required by the NIH.
- Students will attend and present a poster at the in-person VBRN Career Day that will take place in April 2024.
- Students will attend the VBRN Summer Research Symposium in early August 2023.

Questions?

E-mail: vbrn@uvm.edu

RESEARCH LOCATIONS AND JOB DESCRIPTIONS

Bia Diagnostics (Colchester, VT)

<http://www.biadiagnostics.com/>

Bia Diagnostics, an ISO 17025 accredited laboratory, is a world leader in food allergen analysis. In this internship, the student will gain experience working in a fast-paced contract testing laboratory, assisting in processing samples and lab cleaning, while also learning the science behind ELISA and PCR based food testing methodology. During this internship the student will be expected to complete a research project that demonstrates practical hands-on knowledge of these technologies, for example by validating a test kit to industry standards or by testing a variety of store-bought foods for unlabeled allergens or GMOs. At the start the student will be closely supervised. They will become more independent once they are comfortable with routine work. Interns will be working closely with a team throughout the internship and supervisors will be available to answer any questions.

Vernal Biosciences (Colchester, VT)

<https://www.vernal.bio/>

Vernal Biosciences manufactures high purity mRNA for R&D needs that range from concept to clinical. The successful intern will be a motivated self-starter who takes initiative, asks questions, seeks answers, and can make headway at the lab bench. Experience running common protein-, DNA- or RNA- based production procedures, purification and quantitative/qualitative assays is a plus. Responsibilities may include but are not limited to bacterial transformation & scale up, plasmid prep & development, in vitro transcription, RNA capping, DNA/RNA agarose gel image analysis, Western blot, and RNA purification. This is an opportunity to become part of Vermont's burgeoning Biotech scene while learning worthwhile skills in a small team environment!

The Innovation Intern will report to an advisor regularly and be supported by the Innovation team. Intensive hands-on training will take place in the first couple weeks so that the intern can take the reins on an impactful project wherein they will engage in both independent and collaborative research efforts towards a final presentation and report. The ideal candidate will be ready to take initiative, ask questions, and confront innovative challenges head-on. The project will encompass one or more of Vernal's primary process modules (DNA, RNA, or LNP) and may include discovery through analytical development. Project details will be decided upon through conversation with the intern to best align the desires of the individual and the open challenges within the Innovation team.

Prolytix (Colchester, VT)

<https://www.goprolytix.com/>

Founded in 1987 by Kenneth Mann, Ph.D., a prominent scientist in the fields of thrombosis and hemostasis, Prolytix (formerly Haematologic Technologies) quickly developed a reputation as a go-to research reagents company. With expertise in coagulation and hemostasis, we continue to provide highly purified plasma proteins and antibodies to research labs around the world. Recognizing our extensive protein chemistry expertise, biotech companies, pharmaceutical companies, and contract research organizations (CROs) turned to Prolytix for method validation and other analytical and bioanalytical services. To support these endeavors, the company added GMP/GCLP CLIA-certified facilities in 2011 and in 2020, the company added a high-resolution mass spectrometry (HRMS) lab.

With our roster of protein science experts and an integrative approach, we identify and solve complex issues that other CROs cannot. Using high-resolution mass spectrometry (HRMS) and other advanced techniques, Prolytix helps advance large molecule therapies from early development through commercial GMP release. We remain a premier solution for integrated large molecule analytical and bioanalytical services, method and process development, research reagents, custom tubes, and other collection devices. Owing to the diverse nature of our company's capabilities, we are pleased to offer three intern tracks for the summer of 2023.

[Click here for Prolytix internship descriptions \(tracks #1-3\) – see separate doc for now](#)

Dr. Josh Bongard Lab (UVM)
Department of Computer Science
<https://jbongard.github.io/>

The Bongard Lab works to create autonomous robots that can perform a variety of useful tasks, safely. Current research is focused on building robots from soft- and/or biological materials. Students working in the lab are expected to have programming experience in Python, and they should be willing to learn other programming languages and software frameworks. Depending on the project, students work with AI methods, physics engines, supercomputers, biological models, human computer interaction interfaces, and physical robots. The student will work mostly independently and will be assigned a mentor from the pool of PhD students in Dr. Bongard's laboratory. The student will meet with this PhD mentor weekly. Monthly, the student, mentor, and Dr. Bongard will meet to set and check on high-level goals.

Dr. Sean Diehl
Department of Microbiology and Molecular Genetics
<https://www.med.uvm.edu/mmq/faculty/sean-diehl-phd>

The Diehl lab works to develop and test vaccines for infectious diseases of global importance. These include gastrointestinal pathogens norovirus and sapovirus and mosquito-transmitted dengue and zika viruses, all of which cause substantial disease in children worldwide. We work closely with collaborators at the UVM Vaccine Testing Center, Johns Hopkins University, University of North Carolina, Nicaragua, and Bangladesh to conduct cutting-edge clinical and epidemiological studies into how the adult and child immune systems responds to vaccination or infection which guides vaccine design and development of effective means to test for protective immune responses. We focus primarily on antibody-producing B cells and have made many monoclonal antibodies against these viruses that provide insight into how viruses are neutralized.

This internship will involve the optimization of a biological tool that can detect immune responses to norovirus/sapovirus to be harnessed for identification of protective antibodies. Among the new skills to be gained include cell culture, recombinant DNA technology, protein expression and purification, and immunological testing by ELISA. Additional exposure to clinical (translational) research will also be gained alongside training in experimental design, interpretation of results, and presentation of data. We will provide training and resources necessary for successful completion of the project. The PI will guide the design of the project and most lab work will be performed alongside and under the direct supervision of a senior PhD student. Weekly lab meetings will take place where each lab member's project will be discussed (including the internship) to facilitate timely feedback. As the intern becomes proficient in experimental techniques, the PI will assist the intern as they lead production, analysis, interpretation, and presentation of data with the goal that they present their independent work at the annual VBRN Career Day. Our trainees (>20) remain in biomedical research including PhD and medical programs.

Dr. Karen Glass Lab (UVM)
Departments of Pharmacology and Biochemistry
https://www.med.uvm.edu/pharmacology/research_glass_lab

The human genome is compacted into chromatin, allowing nearly three meters of DNA to fit into the small volume of the nucleus. Chromatin is composed of DNA and proteins, and this DNA-protein complex is the template for several essential cell processes including transcription and replication. Understanding the role of chromatin's higher order structure in transcriptional control is important as loss of this regulation underlies many disease processes.

My research program examines how modifications on the nucleosome work as a code to regulate chromatin structure, and to recruit proteins essential for the regulation of diverse cellular process including cellular proliferation, differentiation, gene transcription, and DNA replication and repair. High field Nuclear Magnetic Resonance (NMR) spectroscopy, X-ray crystallography, and biochemical and molecular biology approaches are utilized determine the three-dimensional structures and functions of chromatin binding proteins implicated in many diseases including cancer, cardiovascular disease, neurological disorders, and even parasitic infections.

Internship projects available in the Glass lab are driven by the students interests and will be decided upon at the start of the internship. Students will work on an independent project under the direct guidance and mentorship of another member of the Glass lab (graduate student/postdoc) with weekly meetings with Dr. Glass to discuss progress and goals. There are also weekly lab meetings to provide updates and troubleshoot problems/brainstorm ideas. Students will have the opportunity to utilize all of the techniques routinely used in the Glass lab ranging from molecular biology, e.g., DNA and protein gel electrophoresis, cloning, and mutagenesis, to protein expression and purification, as well as biochemistry and structural biology techniques such as isothermal titration calorimetry, nuclear magnetic resonance, and X-ray crystallography.

Dr. Robert Hondal

Departments of Chemistry and Biochemistry (UVM)

https://www.med.uvm.edu/biochemistry/lab_hondal_research

<https://www.uvm.edu/cas/chemistry/profiles/robert-j-hondal>

Our lab is primarily interested in redox biochemistry. We have several research foci within this general area. First, our lab studies the selenoenzyme thioredoxin reductase. Selenium is an essential trace element for mammals and many other higher eukaryotes. We are interested in trying to understand the chemical basis for the use of selenium in enzymes. Our major hypotheses is that selenium imbues the enzyme with the ability to resist oxidative and electrophilic stress. These hypotheses are tested with in vitro biochemistry and in cellulo assays. The in vitro biochemistry involves enzyme assays and protein engineering to perform structure/function studies. A second redox foci involves the development of peptide therapeutics to treat disease. We have synthesized several mitochondrial targeting peptides that we hope improve mitochondrial function by reducing oxidative stress in the mitochondria. These peptides contain the redox amino acids cysteine, tyrosine, selenocysteine, and 2-thiohistidine. The use of 2-thiohistidine has become a recent major focus of the lab. It is an analogue of the vitamin-like compound ergothioneine. We have harnessed this analogue to develop new peptide technologies.

Summer Student experiences will include training in enzyme assays; training in recombinant protein production and purification; peptide synthesis protein engineering; in cellulo redox assays; scientific writing, data analysis, and presentation; and research methodology and management. We will try to pair the summer student with a grad student in the lab for optimal training.

Dr. Bruno Martorelli Di Genova

Department of Microbiology and Molecular Genetics

https://www.med.uvm.edu/mmg/faculty/bruno_m_digenova_phd

Our lab studies Eukaryotic Pathogens and their interaction with the host. Our long-term goal is to develop efficacious therapies against parasites while learning basic biology. *Toxoplasma gondii* infects 1/3 of the human population, and its infection can produce severe outcomes in immunocompromised patients. Despite being a common infection, there is still no clinical treatment against the infection's chronic stages. Our current project aims to determine the metabolic needs and environmental triggers of the *T. gondii* chronic stage. Our lab uses many techniques to answer these questions, from imaging to OMICS. Those results will reveal new drug targets and treatment strategies against the parasites.

Summer Student experiences will include:

- 1.) Training in tissue culture, including stem cells work and imaging,
- 2.) Molecular biology, cloning, and CRISPR technology.
- 3.) Scientific writing, data analysis, and presentation,
- 4.) Research methodology and management.
- 5.) The overarching goal is to develop students' independence in a lab. The student will be paired with a grad student in the lab for assistance and will have weekly check-in meetings with the supervisor, plus the general lab meeting.

Dr. Kelly Peck Lab (UVM)

Department of Psychological Science

<https://www.uvm.edu/cas/psychology/profiles/kelly-peck>

Over the past five years, I have conducted research focused on the development and evaluation of novel treatments for opioid misuse and use disorder. Most recently, this has included work on two randomized clinical trials evaluating a novel interim buprenorphine treatment for reducing illicit opioid use and other high-risk behaviors among adults with untreated opioid use disorder (OUD). I also have a

research interest focused on the delivery and evaluation of cognitive-behavioral treatments for posttraumatic stress disorder in individuals with concurrent substance use disorders. I am currently preparing to integrate these two areas of research as I direct a study investigating the contribution of prolonged exposure therapy, an efficacious manualized cognitive-behavioral treatment for posttraumatic stress disorder, above and beyond opioid agonist treatment alone for reducing posttraumatic stress disorder (PTSD) symptoms among patients with concurrent PTSD and OUD. Finally, as Director of Clinical Operations for the University of Vermont Center on Rural Addiction (UVM CORA), I lead efforts dedicated to disseminating science-based treatments for OUD and co-occurring issues to rural addiction treatment providers throughout the United States. Thus far, we have established connections with 28,769 rural healthcare providers across nearly 50 states in the 3 years since its inception.

Student experiences may include but are not limited to 1.) opportunities to gain familiarity and working knowledge of evidence-based interventions for OUD and PTSD, 2.) experience administering and interpreting clinical and diagnostic assessment measures, 3.) data management, analysis, and presentation, 4.) scientific writing, 5.) research methodology, and 6.) dissemination of science-based treatments for OUD to rural treatment providers. Completion of introductory courses in behavioral or biological sciences, psychology, social work, public health, health education, or medical areas is desired.

Dr. Jason Stumpff (UVM)
Department of Molecular Physiology and Biophysics
<https://physioweb.uvm.edu/stumpff-lab/>

Our lab utilizes microscopy approaches to investigate cell division and how defects in this process contribute to human diseases, such as cancer. Cell division, in its simplest terms, is the process by which one cell divides to become two. Cellular division is necessary for the survival and development of all organisms, and a key objective during the division process is to equally segregate one complete set of replicated chromosomes to each daughter cell. This step is dependent on the microtubule-based mitotic spindle, which functions as a molecular machine to capture, align, and then partition replicated chromosome pairs. Mitotic spindle function must be tightly regulated to prevent chromosome segregation errors and the production of aneuploid cells, i.e., cells with the wrong number of chromosomes. Aneuploidy is a hallmark of tumor cells, is implicated in the initiation and development of cancer, and is the cause of monosomy and trisomy syndromes. Thus, elucidating the mechanisms underlying the organization and movement of chromosomes within the mitotic spindle is an important step towards a molecular understanding of a wide range of human health disorders.

We have a strong commitment to training undergraduate researchers and helping them launch careers in science and medicine (see the “Lab Members” page of our website for a list of lab alumni and their current positions). We will work with interns to construct a project that aligns their interests with the expertise of the lab. All training and resources necessary for successful completion of the project will be provided, and students will be encouraged to produce, analyze, and interpret data independently once they become comfortable with lab procedures. Students can expect to develop skills in mammalian cell culture, fluorescence microscopy, and quantitative image analysis.

Dr. Markus Thali lab (UVM)
Department of Microbiology and Molecular Genetics
<https://www.med.uvm.edu/mmq/faculty/markus-thali-ph-d>

The Thali lab studies how cell-cell fusion leads to cell reprogramming and endows fused (and thus multinucleated) cells with distinct properties. The two main objects of our studies are T lymphocytes infected with HIV-1 and cytotrophoblasts whose appropriately regulated fusion is required for proper placenta formation in humans and other mammals. The latter project is a collaboration with Elizabeth Bonney, a physician-scientist and Professor and Head at the Division of Reproductive Sciences in the Department of Obstetrics, Gynecology and Reproductive Sciences at UVM's Larner College of Medicine.

For both projects, we are studying processes at the cellular and subcellular level, using both cell lines as well as primary cells. Besides basic cell culture work, the student will be introduced to and will be using various molecular and cell biological techniques (cloning, measuring protein expression, etc.), with an emphasis on using microscopy-based analyses. Work on the HIV-1 projects will NOT include work with live virus, as such work would require training that cannot be accomplished during the summer; also, UVM would not allow such work being done by undergraduate students. Which subprojects the student

will be involved with will be decided only upon arrival and will at least partially be influenced by the student's interests, previous lab experience, and supervision necessary as can be determined in the first two weeks upon the student's arrival. While being introduced into techniques that are new to them, the student is expected to work independently quite rapidly. Typically, though, the student's activities will stay part of a project that is led by a permanent group member, even if the student, through reading about the scientific background and approaches/techniques, is expected to temporarily "co-own" parts of the project.