

Proteomics Internship

Training the next generation of Core Scientists

A screenshot of a web browser displaying the website for the Vermont Biomedical Research Network (VBRN) Proteomics Facility. The browser's address bar shows the URL <https://vbrn.org/proteomics/>. The website header includes the VBRN logo, navigation links for "About VBRN", "BPI Information", "Core Services", and "VBRN News & Highlights", and buttons for "BPI Login" and "Cite VBRN". Below the header is a banner image featuring several test tubes containing liquids of different colors (yellow, blue, red, orange).

Proteomics Facility

RRID:SCR_018667

Wai Lam
Vermont Biomedical Research Network
Proteomics Facility
University of Vermont

Proteomics Internship Program (Incepted in Sept. 2022)

Goals:

- Fulfill the education mission of our funding requirements – educating next-generation scientists
- Interns lead projects to establish workflows for new methodologies

Advertise:

- College website, Biochemistry lab (BIOC 3007 - has a MS component)

Training structure:

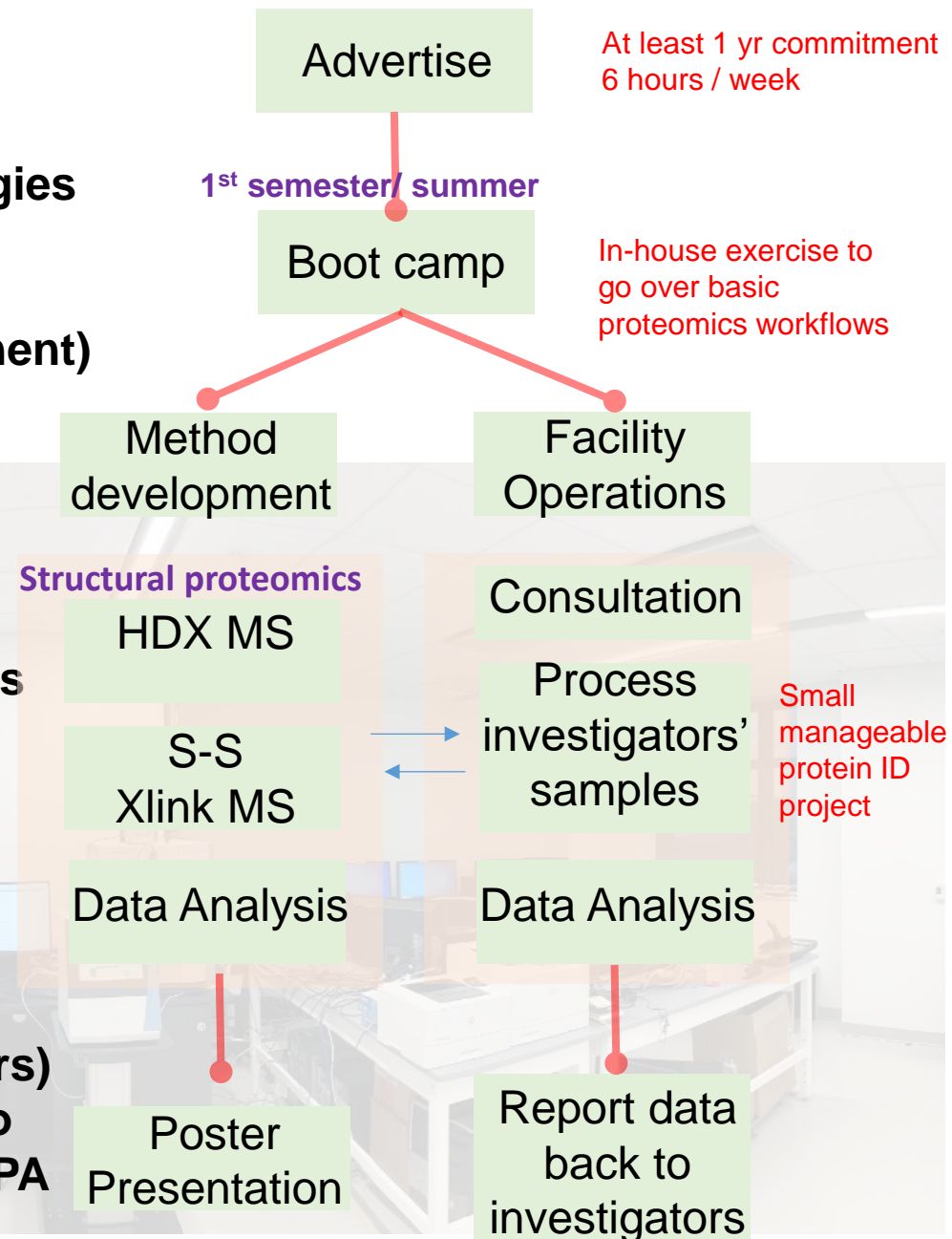
- One-on-one mentor-mentee relationship
- Adjust learning objectives according to individual's interests
- Work in pairs on multiple projects under the same theme
- Achievable goals - plan milestones towards poster presentations

Feedback and Evaluation:

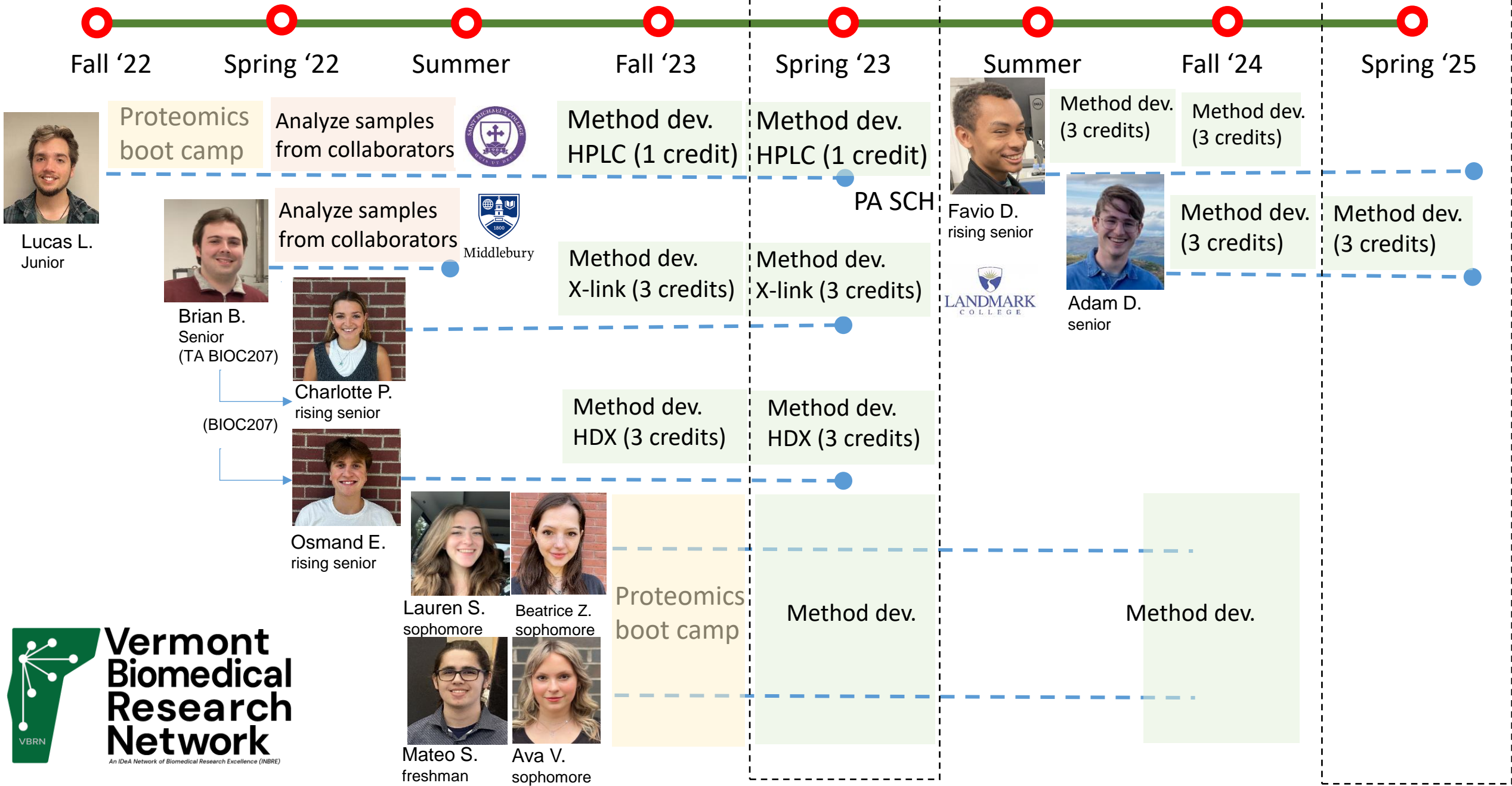
- Internship/research credits (Biology/Biochemistry)
- Poster / term paper in manuscript format (after 6 credits)

Outcomes:

- 10 interns (4 graduated); 3 posters (senior interns as first authors)
- 1 recruited to MIT to develop proteomics methods, 1 recruited to Brown University to work on proteomics projects, 1 enrolled in PA school



VBRN Proteomics Internship



Revitalize obsolete mass spectrometers for method development

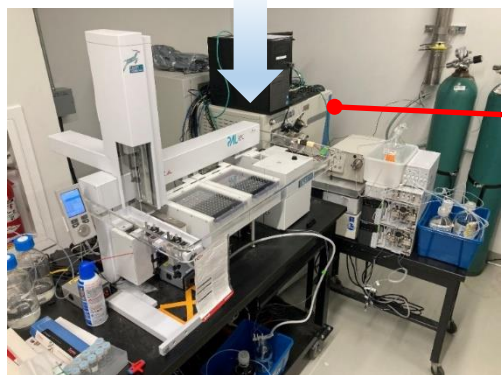
HDX MS



2023 fall

LTQ MS
(2006)

Manual injection
on ice



2024 summer

LTQ-Orbitrap
MS (2008)

Automated liquid
handling, temp. tightly
controlled

Hi-pH reverse-phase HPLC

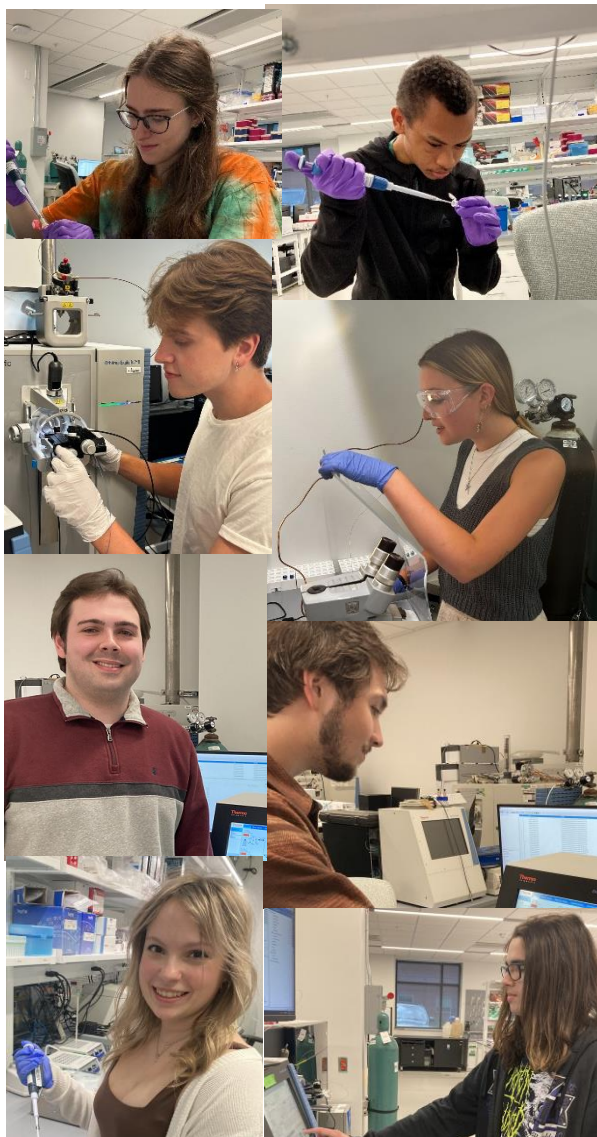


FRACTION COLLECTION

2023 spring –
2004 spring

for TMT peptide
separation and
phosphopeptide
enrichment

Undergraduate access to mass spec instrumentation “CORE-CURE”



Undergraduate presentations at UVM research conference



What our alumni say about the internship

Brian Boyle
Biochemistry

Spring 2022
BIOL190 (3 cr.)

Internship: Help with projects from Middlebury College

I started as an intern at the proteomics facility during January of my senior year. Everyone in the lab was very welcoming and enthusiastic to take me onboard and mentor me. My projects consisted of using LC-MS/MS to identify proteins of interest for different collaborators. It felt very rewarding to be able to play a small role in several different research projects. I learned so many invaluable skills and truly feel that I have been very well prepared for my future career and graduate education.

Lucas Leon
Biology

Fall 2022 – Spring 2024
BIOL190 (6 cr.); BIOL2995 (2 cr.)

Internship: Help with projects from St. Michael College and Middlebury College **Research project: Optimizing High-pH Reversed-Phase HPLC Fractionation Proteomics Workflows**

"As a sophomore biology major, I was questioning whether I wanted to pursue a career in the biotechnology industry or the healthcare industry. I joined this lab because I believed it would give me a good idea of the type of work I would be performing if I were to use my biology degree to get a job in industry. I was able to work with professors across the state of Vermont as a colleague rather than simply an undergraduate. I was given the opportunity to analyze their samples independently and run mass spectrometry experiments with them. I would display and explain any relevant results and help answer questions they had. This was an incredible opportunity for me as I felt I was truly contributing to the field of science. I was involved in a crucial step of many different experiments from scientists in many different fields.

I also spent two semesters working on a method development project, this gave me a feel for research and the process of conducting my own experiments. I got to experience both research and industry-based science which has given me a strong foundation for the future. My experience at the proteomics core has greatly improved my communication skills, leadership skills and professional relationships which I will carry with me in my future career as a physician assistant. It has also exposed me to the niche field of mass spectrometry and proteomics, both of which are extremely employable skills that I can use if I decide to pursue a different career path. All in all, my experience in the proteomics core has been nothing but positive and beneficial for my future and I have been given unique responsibilities and knowledge that few other undergraduate students have which I am very thankful for."

Charlotte Pearson
Biochemistry

Summer 2022 – Spring 2024
BIOL3995 (3 cr.); BIOL3991 (3 cr.)

Research project: Crosslinking Mass Spectrometry and Bioinformatics (XlinkX vs. Kojak)

Over the course of my senior year, I had the opportunity to research mass spectrometry chemical crosslinking methodology working closely with my mentor, Ying Wai Lam, and alongside two other interns, Ava Vitters and Beatrice Zaleski. Working as a research intern in the proteomics facility of the VBRN has been an incredibly rewarding and impactful year, each day bringing forth new challenges and opportunities for growth, whether it was optimizing crosslinking workflows on proteome discoverer or analyzing data sets from collaborating universities. This experience instilled a profound sense of accomplishment as I witnessed firsthand the impact our research had on advancing our understanding of MS crosslinking. Beyond the technical skills gained, I am grateful for the supportive environment fostered by Dr. Lam, Sydney Cohn Guthrie, Osmand Evans, and our entire team. This internship not only enriched my scientific knowledge but also taught me invaluable lessons in perseverance and collaboration. I am truly grateful for the opportunity to have been part of such a dynamic and impactful lab! – Charlotte Pearson

Osmand Evan
Biochemistry

Summer 2022 – Spring 2024
BIOL3995 (3 cr.); BIOL3991 (3 cr.)

Research project: Hydrogen Deuterium Exchange – Mass Spectrometry (HDX-MS)

During my internship (2023-2024), I had the honor of building a strong foundation in proteomics with a focus on HDX-MS methodology. Working closely with collaborators and UVM faculty, I facilitated projects through the VBRN facility and collaborated one-on-one with peers, advisors, and faculty. Although it required hard work, time, and dedication, the supportive environment helped me apply my knowledge from previous courses and fostered my research independence. I highly recommend this internship to any student, as it is truly the integration of a variety of fields in the biological sciences into one internship. Overall, it was an amazing experience. I want to extend a heartfelt thank you to my advisors, Ying Wai Lam and Sydney Cohen, for their time and experience. Without them, this internship wouldn't have been possible. They pushed me to excel and learn as much as I could during my time here.

Benefits

For the undergraduates:

- Unique professional experiences - (“industry” like experience in an academic setting)
- Poster abstracts archived in UVM online ScholarWorks (put on CV)
- Form their own research networks and connections
- Well-trained graduate students-to-be in collaborator’s lab
- A lot of fun!

Nature of the research Internship

- Heavily focuses on analytical instrumentation and its application,
- The intern/research experience will prepare well for someone planning to attend graduate school in analytical chemistry/biochemistry or go into industry
- The experience might not be directly relevant for medical school applications

Suitable candidates

Individuals who are interested in instrumentation work and data analysis

Regular Internship: A minimum of **80** hours/semester is required (1 credit = 40 hours)

For method development project (**200 - 240** hours commitment / year)

For rising seniors, a summer internship is required for joining the following fall semester

Summer Internship: (**8 - 10** weeks: **200 - 350** hours: **25 - 35** hours/week)

Future Plan

- Work with VBRN to recruit undergraduates from local colleges (PUIs)