Holden Nelson

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SUMMARY

I am a STEM graduate student with a strong interdisciplinary background in chemistry, mathematics, and environmental science. I am primarily interested in using chemical and geochemical information to solve environmental forensic problems, such as identifying signature signals to back trace sources of chemical pollution, tracking animal migrations, and discerning mechanisms of naturally occurring processes. Further, I am interested in the application of multiple modes of chemical analysis in pursuit of these goals, with focus on using stable and radiogenic isotope data.

EDUCATION

Ph.D in Integrative Biology and Ecology, Evolution, and Behavior (In Progress) — Expected May 2028
Michigan State University, East Lansing, MI

BS in Chemistry, BA in Mathematics — May 2023
Minors in Environmental Science, General Science — GPA: 4.0/4.0
Westfield State University, Westfield, MA
Senior Thesis: Exploring the relationship between heavy metal content in roadside soils and traffic behavior in western Massachusetts

RESEARCH AND PROFESSIONAL EXPERIENCE

US DOE Science Undergraduate Laboratory Internship Program Student, Ph.D Intern — May 2023 – Present
Pacific Northwest National Laboratory

- Utilized gas chromatography-combustion-isotope ratio mass spectrometry (GC-C-IRMS) to analyze fractions of co-processed petroleum-biofuel mixtures to determine molecular mechanisms of biogenic carbon movement through refineries.
- Prepared samples in both solid and liquid matricies for EA-IRMS analysis to determine $\delta^{13}C$ isotope ratios.
- Wrote manuscript (in progress) comparing spectroscopic and mass spectrometric methods of biocarbon quantification for on-line measurement at petroleum refineries to encourage co-processing of low volume biological feedstocks.

US DOE Science Undergraduate Laboratory Internship Program Student — May – July 2022
Pacific Northwest National Laboratory

- Operated $1.7 million time-of-flight secondary ion mass spectrometer (ToF-SIMS) to analyze the soil organic matter--mineral interface on a variety of synthetic soil samples.
- Utilized novel in-situ liquid SIMS techniques to simultaneously measure the organic and inorganic chemical content of wines.
- Created and interpreted principal component analysis score, loadings, and scree plots to interpret mass spectrometry data of wines and soils.

Water Quality Intern — May – October 2021
Westfield River Watershed Association

- Identified sources of salinity to a local watershed to assist in mitigating surface runoff contamination.
- Used flame atomic absorption/emission spectrophotometry (FAAS/FAES) and ion chromatography to identify ion concentrations in the Westfield River Watershed.
- Generated a local meteoric water line for Western Massachusetts from oxygen and hydrogen isotope ratios to qualify the effect of evaporation on salinity.

Undergraduate Researcher — June – August 2020
WSU Center for Undergraduate Research and Creative Activity (CURCA)

- Performed a literature review on the mitigation of organic chemical pollution from river sediment and focused on the potential application of these methods to the Housatonic River..

Chemistry and Mathematics Tutor, *Westfield State University* — February 2021 – May 2023

PUBLICATIONS

(1) Cheng, C.; Zhou, Y.; **Nelson, H. M.**; Ahmadullah, T.; Piao, H.; Wang, Z.; Guo, W.; Wang, J.-G.; Lai, G.; Zhu, Z. Molecular Identification of Wines Using in Situ Liquid SIMS and PCA Analysis. *Frontiers in Chemistry* **2023**, *11*.

PRESENTATIONS

Nelson, H; Lehmann, S; Moran, J; Bays, T; Nelson, D; Herndon, S; Heredia-Langner, A; Weitz, K; and Wang, H. *Using Stable Isotope Analysis of Fuel Fractions for Biocarbon Tracking in the Refinery Setting.* Presented at the Pacific Northwest National Laboratory Gold Experience Research Symposium, Richland, WA. July 2023.

Nelson, H. *Exploring the Relationship Between Heavy Metal Concentration in Roadside Soils and Traffic Flow in Western Massachusetts*. Presented at Massachusetts Undergraduate Research Conference, Amherst, MA. April 2023

Smith, T; Mathewson, L; Toomey, B; Glinka, J; Lanctot, D; Mantos, P; and **Nelson, H.** *Safety Moments: Fostering Lab Safety Culture at WSU.* Presented at Westfield State University's CURCA, Westfield, MA. December 2022.

Nelson, H and Reyes, A. *Identifying Sources of Salinity in the Westfield River: A Hydrogeochemical Classification of Natural Waters.* Presented at Geological Society of America Connects 2022, Denver, CO. October 2022.

Nelson, H.; Ahmadullah, T; and Zhu, Z. *Studying Soil Organic Matter—Mineral Interactions Using Time-of-Flight Secondary Ion Mass Spectrometry.* Presented at the Pacific Northwest National Laboratory Gold Experience Research Symposium, Richland, WA. July 2022.

Nelson, H. *A Chemist's Guide to Group Theory: Symmetry and Infrared Light.* Presented at the Hudson River Undergraduate Mathematics Conference at Siena College, Loudonville, NY. April 2022.

Nelson, H. *Polychlorinated Biphenyls (PCBs) and their Degradation Products: Detection and Remediation Strategies for Afflicted Communities*. Presented at Massacusetts Undergraduate Research Conference, Amherst, MA. April 2021.

HONORS & AWARDS **Indicates Award Amount >$4000*

Michigan State University Enrichment Fellowship (2023)*
American Chemical Society Connecticut Valley Section Outstanding Senior Award (2023)
Westfield State University Department of Mathematics Academic Excellence Award (2023)
Westfield State University Department of Mathematics Sbrega Departmental Service Award (2023)
Westfield State University Department of Chemical and Physical Sciences Academic Excellence Award (2023)
Massachusetts Commonwealth Honors Scholar (2023)
Westfield State University President's Award for Excellence in Leadership (Fall 2022)
US Department of Energy Science Undergraduate Laboratory Internship Student (Summer 2022, Summer 2023)*
Geological Society of America Northeastern Section Kenneth N. Weaver Student Travel Grant (October 2022)
Westfield State University Mathematics Department Student Highlight (November 2021)
Westfield State Summer Student Undergraduate Research Fellowship (SSuRF) (Summer 2020)*
Senator Paul Tsongas Scholarship (Fall 2019-Spring 2023)*

LEADERSHIP

Student Representative, NE Commission of Higher Education Accreditation Committee October 2021 – May 2023
Student Representative, Chemical & Physical Sciences Department Curriculum Committee October 2021 – May 2023
President, Math Club September 2021 – May 2023

SKILLS

Computer: LaTeX, ArcGIS, Microsoft Excel, Microsoft Word, Zoom
Laboratory: Flame Atomic Absorption/Emission Spectrophotometry, UV-Vis Spectrophotometry, Ion Chromatography, Infrared Spectrometry, Thin Layer Chromatography, Isotope Ratio Mass Spectrometry, Secondary Ion Mass Spectrometry, Dilution, Titration, Micropipetting, Acid Digestion, Gravimetric Analysis, Principal Component Analysis

PROFESSIONAL SOCIETY AFFILIATIONS
American Chemical Society
Pi Mu Epsilon Mathematics Honors Society
Gamma Sigma Epsilon Chemistry Honors Society

COLLEGIATE INVOLVEMENT
Westfield State University Math Club, President (Fall 2020-May 2023)
Westfield State University Biology Club (Fall 2021-Fall 2022)
Westfield State University Musical Theater Guild (Fall 2019- Spring 2020)