Floyd Nichols

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Appointments

2024 – Current: **Postdoctoral Associate**, Geosciences, Virginia Tech.

Education

2019 - 2024: **PhD Candidate**, Earth and Planetary Sciences, Northwestern University. *Advisor Magdalena Osburn*.

August 2015 – May 2019: **B.S., Biology**, Saint Vincent College, Latrobe, Pennsylvania. *Research Advisor Jennifer Koehl, Professor of Biology*.

January 2018 – May 2018: **Study Abroad**, CIEE (Cape Town, South Africa; Paris, France; London, England).

Research and Professional Interests

My research interests include exploring biological signatures through the lens of organic geochemistry and astrobiology. More specifically, I use lipid biomarkers as a tool to evaluate the production and preservation potential of life in hypersaline environments that have similar chemistries to deposits on Mars such as Jezero and Gale Crater. Furthermore, hypersaline environments excel at capturing and preserving precipitation/evaporation signals; however, they are often neglected in climate models despite potentially having a large influence in carbon flux to the atmosphere. As such, I use a combination of lipid biomarkers, organic carbon, and stable isotopes to reconstruct paleohydroclimate in hypersaline systems to help inform present and future climate. Additionally, since hypersaline environments are very complex and often have non-linear patterns, an extension of my work focuses on leveraging machine learning on organic geochemical datasets to reveal patterns within complex data as well as provide agnostic insight into the influence of the signatures that we see.

Research Experience

May 2024 – Present: Postdoctoral Associate, Virginia Tech, Blacksburg, VA.

June 2019 – May 2024: **PhD Candidate**, Northwestern University, Evanston, IL (*Examining Lipid Biosignatures and Organic Carbon in Mars-Analog Hypersaline Lakes*).

September 2018 – May 2019: **Senior Research**, Saint Vincent College, Latrobe, PA (*Determining Microbial Community Shifts in Response to Alkaline Mine Drainage in the Loyalhanna Creek System*).

May 2018 – July 2018: **Research Experience for Undergraduates**, National Science Foundation, Lab of Melissa Berke, Ph.D., University of Notre Dame, South Bend, IN (*Determining Microbial Community with Altitude From the Active Layer of Permafrost Regions*).

July 2017 – Dec 2017: **Research Assistant**, Rachel Harenchar, Saint Vincent College, Latrobe,

PA (*The Influence of Pre-Natal Nicotine Exposure on Ethanol Place Preference in Adolescent Zebrafish*).

Sept 2016 – Feb 2017: **Research Assistant**, Lacie Werner, Saint Vincent College, Latrobe, PA (*Lactobacillus Probiotics Have Sex-Dependent Effects of on Behavior of Maternally Separated Rat Pups*).

May 2016 – Aug 2016: **Research Experience for Undergraduates**, National Heart, Lung, and Blood Institute, Lab of Benjamin Gaston, Ph.D., Case Western Reserve University, Cleveland, OH (*Inhibition of S-Nitrosoglutathione Reductase in Asthma*).

Outreach

Guest Speaker/Expert Speaker

July 2023: **Astronomy on Tap Chicago**: **Life Beyond Earth**, Evanston, IL

April 2022: **Brainstorm: Looking for Life Among the Stars**, The Daily Northwestern, Evanston, IL

December 2021: **Life Beyond Earth?**, Allderdice High School, Pittsburgh, PA

January 2021: **D65 Beacons: Astrobiology**, Washington Elementary School, Evanston, IL

Educational Outreach

March – April 2023: **Cardboard Carnival Challenge**, Evanston, IL, District 65

May – June 2022: **Chicago Public School Volunteer (Biology and AP Environmental Science)**, Lakeview High School

March – April 2022: **Cardboard Carnival Challenge**, Evanston, IL, District 65

October – December 2021: **District 65 Code It! Challenge**, Evanston, IL, District 65

June 2021 – July 2021: **NU GeoPaths Mentor**, Northwestern University

April – May 2021: **Climate Action Project Mentor**, Evanston, IL, District 65

Oct 2020: **Northwestern University Pen Pals Program**, Northwestern University

2017 – 2019: **Planetarium Host**, Saint Vincent College

2015 – 2019: **Bearcat B.E.S.T Buddy**, Saint Vincent College

2017: **Summer Counselor for Young Men and Women in Charge**, Saint Vincent College

Field Experience

2019: Collection of sediment samples, salt samples, filtration of brine fluids, and chemistry data on the water of hypersaline lakes in British Columbia, Canada.

Technical Skills

Laboratory Techniques

- Lipid Extraction, Lipid Separation, H/C/N/S isotope preparation and analysis

Instruments

- GC-MS-FID, EA-IRMS, GC-IRMS, Picarro Water Isotope Analyzer

Software

- R, Python, MatLab, Adobe Creative Cloud, Isodat, Xcalibur

Awards and Honors

2024: EPS Horace A Scott Outstanding Research Award, Northwestern University
2023: Marion Sloss Award for Outstanding Graduate Teaching Assistant, Northwestern University
2019: Saint Vincent College President's Award Winner
2019: The ETS Exam High Score Recipient
2019: John C. Johnson Award for Excellence in Student Research
2015 – 2019: Dean's List (5 semesters) Saint Vincent College, Latrobe, PA
2018: Undergraduate Research Award given to the student who shows an outstanding passion and commitment to research, University of Notre Dame, South Bend, IN
2017: Global Scholars Grant in Honor of Nelson Mandela, For Study Abroad
2017: Service & Leadership Award, Saint Vincent College, Latrobe, PA

Research Grants

2024: **Testing Arid Transformation of Organics via IN-situ Extraction (TATOOINE)**, Planetary Science and Technology Through Analog Research (PSTAR)
2018: **AJ Palumbo Grant**, Saint Vincent College

Professional Activities

May 2024: **Conference Session Convener**, Astrobiology Science Conference
June 2023: **Paleo Early Career Research Panelist**
May 2023: **Future Faculty Workshop Invitee**, University of Notre Dame
2022: **Midwest Geobiology Conference Organizer**
2020 – 2022: **Graduate Student President and Outreach Coordinator** of Northwestern University GeoClub
2019: Academic Careers in Data Science, Northwestern University

Teaching

Teaching Assistant
Fall 2023: **Earth 203: Earth System History**, Northwestern University
Spring 2023: **Earth 370: Geobiology**, Northwestern University
Fall 2021: **Earth 342/ISEN 410: Energy and Climate Change**, Northwestern University
Winter 2019: **NSCI 100 & 101: Astronomy**, Saint Vincent College
Winter 2017: **NSCI 100 & 101: Astronomy**, Saint Vincent College

Mentees

- **Mia Thompson** (Undergraduate Student, *Northwestern University*): 2021 – 2023
- **Kyra Lin** (Undergraduate Student, *Northwestern University*): 2021 - Present
- **Katelyn Patrick** (Undergraduate Student, *(Metropolitan State University of Denver*): Summer 2022
- **Sofia Clark** (High School Student, *Evanston Township High School*): Summer 2021

Publications

In Prep

Nichols, F., Masterson, A. L., & Osburn, M. R. A Multi-Proxy Approach Towards Understanding Hydroclimatic Variability in Mid to Late Holocene in an Ephemeral Hypersaline Lake in Clinton, British Columbia, Canada

Nichols, F., Pontefract, A., Thompson, M.L., Carr, C.E., Masterson, A. L., & Osburn, M. R. Lipid Biomarker Preservation and Diversity in Sulfate-Rich Mars-Analog Hypersaline Lake Sediments.

Nichols, F., Pontefract, A., Carr, C.E., Masterson, A. L., & Osburn, M. R. Examining the Lipidome of Mars-Analog Hypersaline Lakes Using Molecular Networking and Dimensionality Reduction.

In Review

Nichols, F., Pontefract, A., Masterson, A. L., Thompson, M. L., Carr, C., Tuccillo, M. T., & Osburn, M. (2024). Leveraging Machine Learning Approaches to Predict Organic Carbon Abundance in Mars-Analog Hypersaline Lake Sediments. *JGR: Machine Learning and Computation*.

Graham, H. V., Ratliff, L. E., Fulford, A., Pozarycki, C. I., Wimp, G. M., **Nichols, F.**, & Osburn, M. (2023). The Vacant Niche Revisited: Using Negative Results to Refine the Limits of Habitability. *Nature Astronomy*.

Published

Nichols, F., Pontefract, A., Dion-Kirschner, H., Masterson, A.L., and Osburn, M.R. (2023). Lipid Biosignatures from SO_4-Rich Hypersaline Lakes of the Cariboo Plateau. *JGR: Biogeosciences*.

Conference Presentations and Abstracts

Nichols, Floyd, Pontefract, Alexandra, Masterson, Andrew, Thompson, Mia, Tuccillo, Mia, Carr, Christopher, Osburn, Magdalena. (2024). Leveraging Machine Learning Approaches to Predict Organic Carbon Abundance in Mars-Analog Hypersaline Lake Sediments. *Astrobiology Science Conference*. **eLightning Talk**.

Nichols, Floyd, Pontefract, Alexandra, Masterson, Andrew, Osburn, Magdalena. (2023). Lipid Biomarkers in Extremely Sulfate-Rich Hypersaline Lakes. *Brines Across the Solar System Conference*. **Talk.**

Nichols, Floyd, Osburn, Magdalena, Masterson, Andrew, Pontefract, Alexandra. (2022). Lipid Biomarkers in Unique Hypersaline Lakes. *Gordon Research Conference: Organic Geochemistry*. **Poster.**

Nichols, Floyd, Osburn, Magdalena, Masterson, Andrew, Pontefract, Alexandra. (2022) Biosignatures in Unique Mars-Analog Hypersaline Environments. *Astrobiology Science Conference*. **Invited Talk.**

Nichols, Floyd, Osburn, Magdalena., Masterson, Andrew., Pontefract, Alexandra. (2021). Biosignatures in Mars Analog Hypersaline Environments. *Midwest Geobiology Conference*. September 25, 2021. **Poster**.

Nichols, Floyd, Koehl, Jennifer., Mills, Sara. (2019). Microbial Community Shifts in Response to Alkaline Mine Drainage in the Loyalhanna Creek System. *Saint Vincent College Academic Conference*. April 24, 2019. **Talk**.

Nichols, Floyd, Koehl, Jennifer. (2019). Determining Microbial Community Shifts in Response to Alkaline Mine Drainage in the Loyalhanna Creek System. *Tri-Beta Northeastern Region District III Convention*. April 7, 2019. **Poster**.

Nichols, Floyd, O'Connor, Keith, Berke, Melissa, Ziolkowski, Lori. (2019). Determining the Effects of Climate Warming in the Active Layer of Permafrost Regions in Alaska. *Geological Society of America*. March 18, 2019. **Poster**.

Nichols, Floyd, O'Connor, Keith, Berke, Melissa. (2018). Determining Microbial Community Shifts with Altitude from the Active Layer of Permafrost Regions in Alaska. *University of Notre Dame*. July 28, 2018. **Poster**.

Nichols, Floyd, Smith, Laura, Gaston, Benjamin. (2016). Inhibition of S-Nitrosoglutathione Reductase in Asthma. Intersections Undergraduate Poster Session. *Case Western Reserve University*. August 4, 2016. **Poster**.