Julia M. Duncan, PhD

Curriculum Vita

University of Alaska, Fairbanks
Department of Chemistry and Biochemistry
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Education and Training

University of Alaska, Fairbanks – Dept. of Chemistry and Biochemistry
2025 – current: Assistant Professor of Organic Chemistry (tenure track)

University of Wisconsin, Madison - Wisconsin Institute for Discovery
2023- 2024: Postdoctoral Research Associate
Principal Investigator: Jo Handelsman

University of Wisconsin, Madison - Dept. of Chemistry
2021- 2023: Postdoctoral Research Associate
Principal Investigator: Jennifer Schomaker

University of Nevada, Reno - Dept. of Chemistry
2020: Organic Chemistry PhD
Dissertation: Method Development Towards Catalytic Transformations of Reactive Intermediates
Doctoral advisor: Laina Geary

University of Alaska, Fairbanks - Dept. of Chemistry and Biochemistry
2014: Chemistry BS Biochemistry Concentration (*cum laude*), Mathematics Minor
Research Thesis: Preparation of a Novel Frequency Doubling Coordination Complex
Undergraduate Advisor: Fenton Heirtzler

Awards and Honors

Postdoctoral

(11) *2024*: BWF Postdoctoral Diversity Enrichment Program - *declined*
(10) *2021*: NIH Fellowship to Promote Diversity in Health-Related Research

Graduate

(8) *2018, 2019*: Harriet Wolf Scholar
(7) *2018*: Outstanding Graduate Mentor Award
(6) *2017, 2018*: Graduate Dean's Merit Scholar
(5) *2016*: GSA Poster Symposium Science Category
(4) *2015*: Gene and Carla LeMay Scholar

Undergraduate

(3) *2012-2014*: Calista Heritage Foundation Scholar
(2) *2010-2014*: Association of Village Council Presidents Scholar
(1) *2012*: Outstanding Student in Chemistry

Publications and Presentations

Journal Articles

(10) Nicastri, K.A.; Zappia, S.A.; Pratt, J.C.; **Duncan, J.M.**; Guzei, I.A. Fernandez, I.; Schomaker, J.M. "Tunable aziridinium ylide reactivity: non-covalent interactions enable divergent product outcomes," *ACS Catal.* 2022, 12, 1572-1580. https://doi.org/10.1021/acscatal.1c05413

(9) **Duncan, J.M.**; Li, L.; Mohammadrezaei, V.; Geary, L.M. "Scandium and dimethylaminopyridine catalyzed dehydrative coupling of secondary benzylic and primary alcohols to synthesize unsymmetrical ethers," Preprint at http://doi.org/10.26434/chemrxiv.12370574.v1

(8) Roberson, M.G.; **Duncan, J.M. (co-first author)**; Flieth, K.J.; Geary, L.M.; Tucker, M.J. "Photo-initiated rupture of azobenzene micelles to enable the spectroscopic analysis of antimicrobial peptide dynamics," *RSC Adv.*, 2020, 10, 21464-21472. https://doi.org/10.1039/D0RA01920H

(7) Khandelwal, M.; **Duncan, J.M.**; Frost, B.J.; Geary, L.M. "A palladium-silver co-catalyzed aza-Piancatelli rearrangement of furcarbinol acetates to access *N*-substituted cyclopentenones." *Submitted.*

(6) Ryan, K.; **Duncan, J.M.**; Thomas, C.; Chevrette, M.G.; Labby, K.J.; Handelsman, J.; Zamanian, M. "Identification of indole oxazoles with nematocidal activity and evidence of complementary chemoattractants from Pseudomonas soli TE4607." *In prep.*

Dissertation

(5) **Duncan, J.M.** Method Development Towards Catalytic Transformations of Reactive Intermediates, Ph. D Dissertation, University of Nevada, Reno, May 2020. http://doi.org/11714/7408

Professional Presentations

(4) "A Bioassay Guided Approach for Exploring Microbial Chemical Ecology and Phytochemical Adaptation in the Changing Arctic," University of Alaska, Fairbanks, Department of Chemistry and Biochemistry, February 2025.

(3) "Generation of Reactive Intermediates via Lewis Acid Catalysis," ACS Division of Organic Chemistry Graduate Research Symposium 2018, Bloomington, IN

(2) "Scandium Catalyzed Substitution of Benzylic Alcohols," National Organic Chemistry Symposium 2017, Davis, CA

(1) "Method Development towards the Catalytic Synthesis of Heterocyclic Cannabinoids via *Ortho*-Quinone Methides," Canadian Society for Chemistry Conference and Exhibition 2016, Halifax, NS

Academic Experience

Assistant Professor of Organic Chemistry, 2025-current
University of Alaska, Fairbanks

(1) Primary investigator of the Duncan research laboratory at the University of Alaska, Fairbanks – Department of Chemistry and Biochemistry
(2) Teaching Responsibilities:
    - Chem F321 Organic Chemistry I (4 credits)
    - Chem F325 Organic Chemistry II (4 credits)
    - Chem F481/482 Chemistry Seminar (1-2 credits)
    - Chem F420/620 Applications of Spectroscopy (3 credits)
(3) Additional Training
    - Alaska INBRE Data Science Workshop 2025
    - Oxford Nanopore Sequencing Workshop 2025

***Postdoctoral Research Associate,* 2023-2024**
University of Wisconsin, Madison

(1) Isolation and Chemical Characterization of Antibiotic Active Natural Products from Student Sourced Soil Bacteria
    - Developed an experimental pipeline for targeting elucidation, isolation, quantification, and spectroscopic characterization of bacterial secondary metabolites.
    - Extended bioassay guided method development for optimal culturing conditions of soil isolated bacteria conducive to the production of bioactive compounds.
    - Employed advanced analytical tools, such as HPLC, NMR, and LCMS, for chemical characterization.
(2) Method development of an experimental platform for discovery of anthelmintic compounds from soil bacteria.
    - Collaborated with an interdisciplinary team of graduate and professional scientists to develop protocols for the discovery of anthelmintic compounds from natural sources.
    - Used expertise to isolate and characterize novel compounds from chemical extracts from bacterial cultures.
    - Explored nematode chemosensory responses in the presence of bacterial culture extracts.
(3) Additional Training and Workshops
    - Entering Mentoring six-week workshop course
    - LCMS maintenance and repair
    - Appointed Chemical Hygiene Officer for the development and enforcement of chemical safety protocols and emergency response for research laboratories.

***Postdoctoral Research Associate,* 2021- 2023**
University of Wisconsin, Madison

(1) Method Development of Catalytic Group Transfer reactions of Nitrenes and Carbenes to access diverse *N*-heterocycles

- Developed mild strategies to gain access to highly reactive aziridines for use in carbene transfer reactions.
- Employed a variety of catalytic strategies to use electronically diverse carbene precursors to access transient aziridinium ylides capable of generating unique scaffolds via ring expansion.
- Investigated mechanistic hypotheses via stereochemical conservation experiments using HPLC method development.
- Mentored junior graduate students in synthetic strategies, mechanistic theory, and scientific writing.

(2) Towards the Total Synthesis of Jogyamycin

- Implemented a multi-step strategy for the diastereoselective total synthesis of a densely functionalized natural product.
- Employed literature precedent for chemical transformations towards difficult and unstable targets.
- Conducted complex structural analysis using a variety of spectroscopic and spectrometric data.

(3) Additional Training and Workshops

- NIH grant writing workshop for K99/R00 and MOSAIC program
- NIH Responsible Conduct of Research and Scientific Ethics
- Big Ten Academic Alliance PAI Workshop Series:
  Grant Writing Training
  Well-Being and Mental Health
  Conflict Resolution/Difficult Conversation Workshop
  Leading Breakthrough Science Teams

Graduate Research/Teaching Assistant, 2014- 2020
University of Nevada – Reno

(1) Method Development in Catalysis for Organic Synthesis of Bioactive Compounds and Small Molecules

- Planned and executed catalytic screening methods for development of small molecule synthesis and derivatization.
- Designed and synthesized small organic molecules and ligands, cannabinoids, benzopyrans, chromans, benzyl ethers, and cyclopentenones.
- Identified and characterized organic products using analytical instrumentation.
- Elucidated reaction mechanisms using evidence-based support from physical-organic techniques.
- Presented project results in scientific reports, group meetings, and poster sessions at local and national chemistry meetings.
- Provided in-depth training and problem-solving instruction to undergraduate and graduate students in instrument operation and maintenance, and data processing.
- Led organic teaching laboratories for both major and non-major undergraduate students.

(2) Graduate Teaching Assistantships

- General Chemistry Laboratory 1 — Fall 2014
- Organic Chemistry Laboratory 1 (non-major) — Spring 2015, Fall 2017
- Organic Chemistry Laboratory 1 (major) — Fall 2015, Fall 2016
- Organic Chemistry Laboratory 2 (major) — Spring 2016, Spring 2017

Undergraduate Researcher**,** 2012-2014
University of Alaska, Fairbanks

(1) Synthesis of Highly Conjugated Ligands for Nonlinear Optic Coordination Complexes

- Planned and executed synthetic procedures in an organic laboratory for the target-based synthesis of chiral heteroarenes to be used as ligands in copper complexes.
- Independent operation of analytical equipment including NMR, IR, UV-Visible Diode Array Spectrometers, and Mass Spectrometers.
- Presented project results in reports, talks, and posters.

Skills

- Ability to efficiently set up a laboratory that is conducive to active research in the fields of organic synthesis, chemical ecology and microbiology.
- Advanced technical knowledge of chemistry laboratory techniques including synthesis of organic material in multistep processes.
- Trained in microbiology techniques such as aseptic techniques, culturing on solid or in liquid media, microscopy, optical processing, and bioassay design.
- Safe handling of biohazardous material and pathogenic microbes.
- Advanced technical ability to isolate and purify organic and organometallic material via chromatography, distillation, or crystallization.
- Extensive use of structural instrumentation such as NMR, GC and LCMS, chiral HPLC, IR, Optical Rotation, etc.
- Knowledge of HPLC and LCMS instrument general maintenance and repair.
- Well-versed analysis of spectra as used for reaction development and interpretation, and identification of new molecules and metabolic profiling.
- Method development experience of *in situ* reaction monitoring techniques by NMR and React-IR for mechanistic elucidation or determination of kinetic parameters.
- Strong ability to clearly document and communicate results in a scientific manner via handwritten and electronic notebooks, oral presentations, meetings, and reports.
- Ability to safely handle toxic, corrosive, pyrophoric, explosive or moisture sensitive reagents using glovebox and Schlenk line techniques.
- Experience in the use of transition metal or Lewis acid catalyzed small molecule synthesis.
- Direct experience in mentorship and supervision of incoming students which includes training individuals for safety protocols, waste management, and lab technique.
- Primary chemical safety oversight of laboratory operations, maintenance of stock, and bench equipment repair and maintenance.

- Computer literacy in MS-Office, ChemDraw, MestraNova, SciFinder, Reaxys, Signals electronic notebooks, Compound Discoverer and other processing and database discovery software.

Volunteering and Club Activities

(7) UAF Science Potpourri 2025
- Hosted a hands-on demonstration for public participants of all ages that conceptualized diffusion.

(6) Alaska Science Olympiad 2025
- Designed and planned a competitive forensic chemistry lab experiment, CrimeBusters, for middle school students from across Alaska to inspire interest in STEM fields.
- Hosted a group of middle school students and coordinated the CrimeBuster activity.

(5) Tiny Earth Chemistry Hub, 2023-2024
- Provided chemistry concept lectures and research talks to a broad audience of national and international students, and partner instructors to promote interest in discovery of antibiotics from soil bacteria.
- Gave chemistry demonstrations and guided hands-on activities for students within the Tiny Earth network.

(4) UW-Madison Arboretum, 2023-2024
- 40+ hours of participation in ecological restoration work parties that manage and promote healthy plant species native to prairies, savannas, and woodlands of the Mid-West.
- Activities involved identifying native and invasive plant communities, removal of invasives in dense growth and uncertain terrain, brush cutting and wildfire risk reduction.

(3) UW-Madison Queer in Chemistry, 2021-2023
- Advocate for inclusivity and equitable opportunities in the physical and life science fields for LGBTQ+ community members.
- Participated in community building activities that offer a safe space for LGBTQ+ members to network and discuss career development.

(2) UNR Chemistry Graduate Student Association Outreach, 2014-2017
- Contributed to the design and performance of chemistry demonstration lectures for large audiences of K-12 students.
- Volunteered time to provide lab coats and goggles to incoming undergraduates to reinforce chemistry teaching laboratory safety rules.

(1) UAF ACS Undergraduate Chemistry Outreach, 2011-2014
- President 2013-2014, Organized community outreach events featuring chemistry demonstration lectures for K-12 students to inspire interest in the sciences.
- Ordered supplies for interactive student participation in demonstrations.