Ryan J. Rafferty

Department of Chemistry, Kansas State University • Manhattan, KS 66506 • (785)532-6624 • rjraff@ksu.edu

Education

Ph.D. in Organic Chemistry, Colorado State University, Fort Collins, CO 2005-2011
M.S. in Biochemistry, University of Northern Colorado, Greeley, CO 2001-2004
B.S. in Molecular Biology, University of Northern Colorado, Greeley, CO 2000-2002
B.S. in Chemistry (Biochemistry Emphasis), University of Northern Co, Greeley, CO 1996-2000

Positions and Employment

Assistant Professor 2014-Present
Department of Chemistry, Kansas State University, Manhattan, KS
Other affiliations: Member, Johnson Cancer Center 2014-Present
Member, Biochemistry and Molecular Biophysics Graduate Group 2015-Present

Visiting Lecturer of Organic Chemistry 2012-2014
Department of Chemistry, University of Illinois, Urbana-Champaign

Post-Doctoral Researcher 2011-2014
Department of Chemistry, University of Illinois, Urbana-Champaign
Advisor: Prof. Paul J. Hergenrother

Graduate Research Assistant 2005-2011
Department of Chemistry, Colorado State University, Fort Collins, CO
Advisor: Prof. Robert M. Williams

Lecturer of Organic Chemistry 2006-2009
Department of Chemistry, Colorado State University, Fort Collins, CO

Adjunct Chemistry Instructor 2012-2013
Parkland Community College, Champaign, IL

Adjunct Chemistry Instructor 2002-2009
Aims Community College, Greeley, CO

Graduate Research Assistant 2001-2004
Department of Chemistry, University of Northern Colorado, Greeley, CO
Advisor: Prof. Richard M. Hyslop

Honors and Awards

2019 NSF-CAREER Award
2017 Thieme Chemistry Journal Award, Thieme Publishing
- Awarded Annually to up-and-coming early stage academic researchers worldwide, selected by editors of the journals

2016 Stamey Undergraduate Teaching Award, College of Arts and Sciences, Kansas State University
- In Honor of William L. Stamey, this award is given awarded to faculty in recognition of outstand teaching within the College

2013 Illinois Student Senate Teaching Excellence Award, University of Illinois, Urbana-Champaign
- In recognition of outstanding classroom instruction, 1 of 5 awardee's from over 600 nominations

2012 List of Teachers Ranked as Excellent by their Students, University of Illinois, Urbana-Champaign
2007 Graduate Student Award for Teaching Excellence, College of Natural Sciences, Colorado State University
2005 Chemistry Graduate Teaching Assistant Award, Department of Chemistry, Colorado State University
2003 Graduate Dean's Citation for Outstanding Thesis, University of Northern Colorado

2003 Graduate Dean's Citation for Excellence, University of Northern Colorado
2003 Outstanding Graduate Research Award, Colorado-Wyoming Academy of Science
2000 Outstanding Biochemistry Undergraduate Student Award, University of Northern Colorado

Research Overview

Research in the Rafferty group focuses on the discovery of new bioactive agents via total synthesis, chemical library construction, re-purposing of old therapeutics, and the development of new means of agent delivery; all rooted in natural products. Our discovery of new bioactive agents is through the chemical diversification of intermediates within our total synthesis routes of the natural products investigated, including, but not limited to the balgacyclamide, brocazine, and chalcone families of natural products. This strategy has allowed for the access of unique scaffolds of biological importance. In addition, these new diversified intermediates have been transformed into new chemical libraries that possess tunable and selective transformative properties that are being used in the development of new chaperone-like small molecules (CLSMs) to aid in the transport of agents of interest across complex biological barriers. We have advanced projects that employ these CLSM for the delivery of agents, which alone have no penetration properties, into gram-negative bacteria as well as across the blood-brain barrier.

Postdoctoral Fellows Supervised

Name	Doctoral Program/Advisor	Dates Supervised	Current Employer
Dr. Ashabha Lansakara	U. of Iowa/Prof. Pigge	2016-2017	Cambridge Isotope Lab
Dr. Thi Nguyen	Kansas State/Prof. Hua	2014-2015	Pfizer

Graduate Students Supervised

Name/Current Employer	Undergraduate Institution	Years Supervised	Degree
Asantha Fernando	University of Colombo	2018-Present	Ph.D., Expected 2023
Shashika Perera	Institute of Chemistry, Ceylon	2018-Present	Ph.D., Expected 2023
Anthony Fatino	University of Central Missouri	2016-Present	Ph.D., Expected 2021
Prathibha Desman	University of Colombo	2015-Present	Ph.D., Expected 2020
Wasundara Hulangamuwa	University of Colombo	2015-Present	Ph.D., Expected 2020
Dr. Chamitha Weeramange (PostDoctoral Researcher, Univ. Kansas)	Witicha State University	2014-2018	Ph.D., 2018
Chelsea Weese (Lecturer: Highland Community College)	Kansas Wesleyan University	2014-2018	M.S., 2018

Undergraduate Students Supervised

[a]Completed Undergraduate Chemistry Senior Thesis *[b]Funded by Awards Secured by the PI*

Name	Degree	Years Supervised
Ashely Bartels[b]	B.S., Chemical Engineering	2018-Present
Johnathan Dallman[b]	B.S., Chemistry	2016-Present
Adam Ebert[b]	B.S., Biochemistry	2018-Present
Brittany Funk[b]	B.S., Chemical Engineering	2018-Present
Olivia Haney[a,b]	B.S., Chemistry	2016-2018
Hannah Henderson[a,b]	B.S., Chemistry	2017-2018
Elizabeth Poppe	B.S., Life Sciences (Chemistry)	2014-2015 & 2017-2018
Skyler Roth[a]	B.S., Chemistry	2017-2018
Kelsey Ferguson[b]	B.S., Biochemistry	2014-2018
Lydia Lawlor[a]	B.S., Chemistry	2016-2017
Orlando Anderson	B.S., Biology	2015-2016
Giovanna Baca	B.S., Biology	2015-2017
Morgan Fortunski[a,b]	B.S., Chemistry	2015-2017
Clay Schemn[b]	B.S., Food Sciences	2015-2016
Melissa Small[b]	B.S., Biochemistry	2015-2016
Cassie Binns[b]	B.S., Biochemistry	2014-2016
Yichao Zhang[b]	B.S., Chemical Engineering	2014-2016
Adam Elkiwan[b]	B.S., Biology	2014-2015
Vinh Hoang[a,b]	B.S., Chemistry	2014-2015

Summer Students Supervised

Name	Home Institution	Program	Year
Arnaldo Torres Hernandez	Pontifical Catholic Univ.	NSF REU	2018
Casey House	Oklahoma Baptist Univ.	NSF-REU	2017
Arnaldo Torres Hernandez	Pontifical Catholic Univ.	SUROP	2017
Kayla St. Laurent	Kansas Wesleyan Univ.	SUROP	2016
Dalia Sanchez	Kansas State Univ.	SUROP	2015
Salvador Valdez	Liberal Community College	KSU-Bridges	2015

Courses Taught

Year	Semester	Course	Course Title	# Students	Ranking*
2018	Fall	CHM 550	Organic Chemistry II	76	HM
2018	Summer	CHM 350	Gen. Organic Chemistry	42	H
2018	Spring	CHM 531	Organic Chemistry I	109	HM
2017	Fall	CHM 752	Advanced Organic Chemistry	8	HM
2017	Spring	CHM 350	Gen. Organic Chemistry	153	H
2016	Fall	CHM 752	Advanced Organic Chemistry	6	HM
2016	Summer	CHM 350	Gen. Organic Chemistry	35	H
2016	Spring	CHM 350	Gen. Organic Chemistry	152	H
2015	Fall	CHM 550	Organic Chemistry II	79	H
2015	Summer	CHM 350	Gen. Organic Chemistry	36	H
2015	Spring	CHM 965	Physical Organic Chemistry	5	HM
2014	Fall	CHM 550	Organic Chemistry II	67	H

*Ranking based upon score for "overall effectiveness as a teacher", relative to KSU classes rated by 10 or more students. H: Upper 10%, HM: Next 20%; M: Middle 40%, LM: Next 20%, and L: Lowest 10%

Departmental and University Service

Chemistry Department NMR User Committee, **2017-Present**
Chemistry Department Alumni Affairs and Outreach Committee, **2017-Present**
NMR Director Search Committee, **2017**
American Chemical Society Student Affiliate, Faculty Advisor, **2016-Present**
Chemistry Department Website Committee, **2015-Present**
Chemistry and Physics Symposium, **2018-Present**

Ph.D. Graduate Committee Member for Elizabeth Goentzel (PI: Peter Sues) **2017-Present**
Ph.D. Graduate Committee Member for Sagar Rayamajhi (PI: Santosh Arayal) **2017-Present**
Ph.D. Graduate Committee Member for Anjana Delpe Acharige (PI: Stefan Bossmann) **2016-Present**
Ph.D. Graduate Committee Member for Kanchana Saarakoon (PI: Tendai Gadzikwa) **2016-Present**
Ph.D. Graduate Committee Member for Jay Sibbitts (PI: Christopher Culbertson) **2014-Present**
Ph.D. Graduate Committee Member for Tuyen Nguyen (PI: Santosh Arayal) **2014-Present**
Ph.D. Graduate Committee Member for Bhupinder Sandhu (PI: Christer Aakeroy) **2014-2018**

External Service

American Chemical Society Local Section, Chair, **2015-2016**
2016 Midwest American Chemical Society Meeting – Chair of Undergraduate Research Session
NSF Review Panel Member (GRFP), *3 Panels*
NSF Review Panel Member (Chemical Synthesis), *2 Panels*
NSF Review Panel Member (CAREER), *1 Panel*
Reviewed at least one manuscript for:

ACS Combinatorial Science
ChemMedChem
Journal of the American Chemical Society
Journal of Chemical Education
Journal of Natural Products
Nanomedicine
Organic Letters
Scientific Reports
Tetrahedron
Tetrahedron Letters

The Chemical Educator *The Journal of Organic Chemistry*

Current Research Support

National Science Foundation-CAREER 07/1/2019 – 06/30/2024
"CAREER: Penetrating Barriers – A New Paradigm for Enhancing Molecular Transport into Complex Biological Membranes" Role: PI

Johnson Cancer Research Center, Innovative Research Award Spring 2018
"Synergist Therapy for Enhanced Anticancer Agent Delivery: Magnetic Field Facilitated Nanoparticle Microporation" Role: Co-PI *with Prof. Viktor Chikan*

Johnson Cancer Research Center, Innovative Research Award Fall 2016
"Determining the mode of toxicity associated with 6-thiopurine administration in the treatment of acute lymphoblastic leukemia" Role: PI

Completed Research Support

Johnson Cancer Research Center, Innovative Research Award Fall 2015
"Understanding and elucidating the target point of toxicity of the approved and clinically used leukemia drug 6-thiopurine" Role: PI

Johnson Cancer Research Center, Equipment Award Fall 2015
Refractive Index Detector and Fraction Collector Role: PI

Johnson Cancer Research Center, Equipment Award Spring 2015
Liquid Plate Transfer Handling System Role: PI

Johnson Cancer Research Center, Graduate Student Summer Award 6/1/2018 – 8/15/2018
Summer Graduate Student Support for Anthony Fatino Role: PI

Johnson Cancer Research Center, Graduate Student Summer Award 6/1/2016 – 8/15/2016
Summer Graduate Student Support for Wasundara Hulangamuwa Role: PI

Johnson Cancer Research Center, Graduate Student Summer Award 6/1/2015 – 8/15/2015
Summer Graduate Student Support for Chelsea Weese Role: PI

Professional Development and Training

2018-2019 Association of College and University Educators (ACUE)
2018 NSF CAREER Workshop, hosted by Carleton College and University of Colorado
2016 NIH New Faculty in Organic and Biological Chemistry Workshop
2014 Cottrell Scholars Collaborative New Faculty Workshop

Peer-Reviewed Publications

Independent Publications (KSU Undergraduate Researchers indicated by ^{UG}, postdoctoral researchers are underlined, graduate researchers are in normal text, and * indicates corresponding author):

12. Dallman, J.^{UG}; Lansakara, A.; Nguyen, T.; Weeramange, C.; Hulangamuwa, W.; **Rafferty, R. J.*** "The Winding Road of the Uvaretin Class of Natural Products: From Total Synthesis to Bioactive Agent Discovery" (*Submitted*)

11. Weeramange, C.; Lansakara, A.; Dallman, J.^{UG}; Nguyen, T.; Hulangamuwa, W.; **Rafferty, R. J.*** "New Methods to Assess 6-Thiopurine Toxicity and Expanding its Therapeutic Application to Pancreatic Cancer via Small Molecule Potentiators" (*Submitted*)

10. Torres-Hernandez, A.^{UG}; Weeramange, C.; Desman, P.; Fatino, A.; **Rafferty, R. J.*** "Efforts in Redesigning the Antileukemic Drug 6-Thiopurine: Decreasing Toxic Side Effects While Maintaining Efficacy" *MedChemComm*, **2019**, *10*, 169-179.

9. Fatino, A.; Weese, C.; Valdez, S.[UG]; Jimenez-Somarribas, A.; **Rafferty, R. J.**[*] "Synthetic Studies Towards Lagunamide C: Polyketide Assembly Investigations" *Tetrahedron Let.*, **2018**, *59*, 624-627.

8. Weeramange, C.; Binns, C.[UG]; Chen, C.; **Rafferty, R. J.**[*] "Inhibition Roles of 6-Thiopurine and its Excretion Metabolites upon UDP-Glucose Dehydrogenase and UDP-Glucuronosyl Transferase" *J. Pharm. Biomed. Anal.*, **2018**, *151*, 106-115.

7. Fatino, A.; Baca, G.[UG]; Weeramange, C.; **Rafferty, R. J.**[*] "Total Synthesis and Evaluation of Reniochalistatin E" *J. Nat. Prod.*, **2017**, *80*, 3234-3240.

6. Hoang, V.[UG]; Zhang, Y.[UG]; **Rafferty, R. J.**[*] "In Pursuit of balgacyclamide A – Discovery of an oxazoline macrocycle with multiple myeloma cytotoxicity and penetration" *Tetrahedron Let.*, **2017**, *58*, 4432-4435.

Graduate and Postdoctoral Publications:

5. **Rafferty, R.J.**, Hicklin, R. W., Maloof, K. A., and Hergenrother, P. J.[*] "Synthesis of Complex and Diverse Compounds via Ring Distortion of Abietic Acid." *Angew. Chem. Int. Ed.* **2014**, *53*, 220-224.

4. **Rafferty, R. J.** and Williams, R. W.[*] "Formal Synthesis of Hapalindole O and Efforts Towards Ambiguine A." *Heterocycles*, **2012**, *86*, 219-231.

3. **Rafferty, R. J.** and Williams, R. W.[*] "Total Synthesis of Hapalindoles J and U." *J. Org. Chem.* **2012**, *77*, 519-524.

2. **Rafferty, R. J.** and Williams, R. W.[*] "Synthetic Studies on the Ambiguine Family of Alkaloids: Construction of the ABCD Ring System." *Tet. Lett*. **2011**, *52*(17), 2037.

1. Artman, G.; **Rafferty, R. J.**; Williams, R. M.[*] "(3R,7aS)-3-(Trichloromethyl)tetrahydro-pyrrolo[1,2-c]oxazol-1(3H)-one: An Air and Moisture Stable Reagent for the Synthesis of Optically Active a-Branched Prolines." *Org. Syn*. **2009**, *86*, 262.

Patents

2. **Rafferty, R. J.** Re-design of the anti-leukemic cancer drug 6-thiopurine. U.S. Provisional Patent Submitted, 2018.

1. **Rafferty, J. R.**; Chikan, V. Synergist Therapy for Enhanced Drug Delivery: Magnetic Field Facilitated Nanoparticle Microporation. U.S. Provisional Patent Submitted, 2018.

Invited Talks

15-17. University of Colorado, Purdue University ***To be Scheduled***

14. "The Never-Ending Story in Total Synthesis: Bioactive Agent Discovery to Unlocking Complex Biological Barrier Transport" **Scheduled April 24, 2019**, Baylor University, Waco, TX

13. "The Never-Ending Story in Total Synthesis: Bioactive Agent Discovery to Unlocking Complex Biological Barrier Transport" **Scheduled April 19, 2019**, Louisiana State University, Baton Rouge, LA

12. "The Never-Ending Story in Total Synthesis: Bioactive Agent Discovery to Unlocking Complex Biological Barrier Transport" **Scheduled March 19**, University of Illinois, Chicago, IL

11. "The Never-Ending Story in Total Synthesis: Bioactive Agent Discovery to Unlocking Complex Biological Barrier Transport" **Scheduled March 8, 2019**, University of Kansas, Lawrence, KS

10. "The Never-Ending Story in Total Synthesis: Bioactive Agent Discovery to Unlocking Complex Biological Barrier Transport" **Scheduled February 7, 2019**, Oklahoma State University, Stillwater, OK

9. "The Role of Natural Products in Bioactive Agent Discovery and Unlocking Complex Barrier Transport" **October 19, 2018**, University of Northern Colorado, Greeley, CO

8. "The Role of Natural Products in Bioactive Agent Discovery and Unlocking Complex Barrier Transport" **October 17, 2018**, Department of Biochemistry, Kansas State University, Manhattan, KS

7. "In the Search of Bioactive Agents and New Tools for Delivery" **September 21, 2018**, Pittsburg State University, Pittsburg, KS

6. "In the Search of Bioactive Agents and New Tools for Delivery" **February 19, 2018**, Fort Hayes University, Hayes, KS

5. "Total Synthesis and Natural Products: New Methods for Chemical Screening Library Construction and Applications" **October 20, 2017**, 52nd Midwest Regional American Chemical Society Meeting (Invited Speaker to Special Topics of Organic Chemistry), University of Kansas, Lawrence, KS

4. "Discovery of the next generation of therapeutics: Harnessing the power of medicinal chemistry and total synthesis" **January 30, 2017**, University of Nebraska, Omaha, NE

3. "Therapeutic Agent Discovery: Where have new therapeutic scaffolds gone? Investigations into the assembly of new screening libraries and targeted drug delivery" **November 9, 2015**, Emporia State University, Emporia, KS

2. "Therapeutic Agent Discovery: From Natural Products, Epigenetics, to Diversity Orientated Synthesis: Where will the next therapeutic scaffold come from?" 50th Midwest Regional American Chemical Society Meeting (Invited Speaker for Therapeutic Agent Discovery), **October 22, 2015**, Saint Joseph, MO

1. "From Chemistry Major to Professor: The winding journey through organic chemistry and chemical biology" **October 13, 2014**, University of Nebraska, Omaha, NE

Oral and Poster Talks

Independent Career Presentations (Presenter in Bold)

14. **Rafferty, R. J.** "Exploring the Spatial Effects of Charge upon Porin-Mediated Gram-Negative Bacteria Transport" *257th National American Chemical Society Meeting*, **2019**, Orlando, FL; oral presentation.

13. **Rafferty, R. J.** "Lagunamide C: Total Synthesis Efforts, Final Structural Determination, and Biological Evaluation" *257th National American Chemical Society Meeting*, **2019**, Orlando, FL; oral presentation.

12. **Rafferty, R. J.** "Exploiting Synthesis Inherent in Total Synthesis Campaigns: New Avenues for Bioactive Agent Discovery" *257th National American Chemical Society Meeting*, **2019**, Orlando, FL; oral presentation.

11. **Rafferty, R. J.** "Unlocking Complex Barrier Transport via Chaperone-like Small Molecules: A New Platform for Gram-Negative Bacteria and Blood-Brain Barrier Penetration" *257th National American Chemical Society Meeting-Early Career Investigator in Biological Chemistry*, **2019**, Orlando, FL; oral presentation.

10. Nguyen, T.; Desman, P.; Fatino, A.; Hulangamuwa, W.; House, C.; **Rafferty, R. J.** "A New Paradigm in Complex Barrier Transport: Exploration of Chemical Space through Total Synthesis Rotes of Natural Products" *Gordon Research Conference: Natural Products and Bioactive Agents,* **2018**, Proctor Academy, NH; poster.

9. Hulangamuwa, W.; Desman, P.; Nguyen, T.; **Rafferty, R. J.** "Discovery of New Bioactive Molecules and Approaches to New Chemical Screening Libraries" *255th National American Chemical Society Meeting*, **2018**, New Orleans, LA; oral presentation.

8. Fatino, A.; Weese, C.; **Rafferty, R. J.** "Lagunamide C: Efforts in Total Synthesis, Biological Evaluation, and Drug Delivery" *255th National American Chemical Society Meeting*, **2018**, New Orleans, LA; oral presentation.

7. Weese, C.; Fatino, A.; Hoang, V.[UG]; Zhang, Y.[UG]; Hulangamuwa, W.; Nguyen, T.; **Rafferty, R. J.** "Year Three: Complex Small Molecule Synthesis with various Biological Activities: Total Synthesis, Library Design, and Complex Barrier Transport Investigations" *Gordon Research Conference: Natural Products and Bioactive Agents,* **2017**, Proctor Academy, NH; poster.

6. Fatino, A.; Desman, P.; Hulangamuwa, W.; Weese, C.; Baca, G.[UG]; Fortunski, M.[UG]; Zhang, Y.[UG]; **Rafferty, R. J.** "Year Two: Total Synthesis, Library Construction, and Chemical Probes from Natural Products" *Gordon Research Conference: Natural Products and Bioactive Agents,* **2016**, Proctor Academy, NH; poster.

5. Nguyen, T.; Weese, C.; Small, M.[UG]; Zhang, Y.[UG]; **Rafferty, R. J.** "Year One: Synthetic Efforts towards Bioactive Compounds, Analogs, and Biological Evaluation" *Gordon Research Conference: Natural Products and Bioactive Agents,* **2015**, Proctor Academy, NH; poster.

As of Jan 2019: 7 Student Oral and 12 Student Poster Presentations at Regional and National Meetings

Graduate and Postdoctoral Presentations (Presenter in Bold)

4. **Rafferty, R. J.;** Hicklin, R.; Maloff, K.[UG]; Hergenrother, P. J. "Synthesis of Structurally Complex and Diverse Compounds from Abietic Acid" *Gordon Research Conference: Natural Products,* **2015**, Proctor Academy, NH; poster.

3. **Rafferty, R. J.** and Robert M. Williams, "Studies Towards the Total Synthesis of the Marine Alkaloids Ambiguines E and F" *9th Winter Conference Medicinal and Bioorganic Chemistry Foundation*, **2009**, Steamboat Springs, CO; poster.

2. **Rafferty, R. J.** and Robert M. Williams, "Studies Towards the Syntheses of Antifungal Alkaloids Ambiguines E & F" *The Albert I. and Joan Meyers Symposium*, **2009**, Fort Collins, CO; poster.

1. **Rafferty, R. J.** and Hyslop, R.; "Assessment of Dehydrogenase Enzyme Activities by RP-HPLC" *HPLC Symposium*, **2004**, Philadelphia, PA; oral presentation.