

# Joseph Chihade

Department of Chemistry  
Carleton College  
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## Positions:

- 2014-present Carleton College, Northfield, MN  
Professor of Chemistry
- 2015- 2016 Sabbatical leave from Carleton College in the “Architecture and Reactivity of RNA”  
research unit of the Centre National de la Reserche Scientifique (CNRS) - University of  
Strasbourg, France
- 2007-2014 Carleton College, Northfield, MN  
Associate Professor of Chemistry
- 2003-2007 Carleton College, Northfield, MN  
Assistant Professor of Chemistry
- 2002-2003 Assistant professor leave from Williams College in the laboratory of Prof. Karin Musier-  
Forsyth, University of Minnesota, Minneapolis, MN.
- 1999-2003 Williams College, Williamstown, MA  
Assistant Professor of Chemistry
- 1996-1999 NIH Post-doctoral fellow under the direction of Prof. Paul Schimmel at the Massachusetts  
Institute of Technology, Cambridge, MA and The Scripps Research Institute, La Jolla, CA.  
Evolutionary origins of aminoacyl-tRNA synthetases. Substrate specificity of  
mitochondrial aminoacyl-tRNA synthetases.
- 1991-1996 Graduate student under the direction of Prof. David Horne at Columbia University, New  
York, NY. Substrate specificity of tRNA pseudouridine synthases.
- 1989-1991 Peace Corps. Secondary level science and math teacher at St. Stephen's Lwanya Secondary  
School, Busia, Kenya.
- 1989 Summer research internship at British Petroleum America, Cleveland, OH.  
Development of polymer blends.
- 1988-1989 Honors research under the direction of Prof. Roy Jacobsen at Oberlin College, Oberlin,  
OH. Partial synthesis of corranulene.
- 1988 Summer research under the direction of Prof. Joseph Marino at the University of Michigan,  
Ann Arbor, MI. Synthesis of macrocyclic polysulphoxides for use as anion specific  
cryptands.

## Education:

- 1991-1996 Columbia University, New York, NY  
Ph. D. in Chemistry, 1996.  
Thesis title: “Determinants for tRNA Modification by E. coli Pseudouridine Synthase I”
- 1985-1989 Oberlin College, Oberlin, OH  
B.A. with Honors, 1989. Major: Chemistry, Minor: Russian  
Honors Thesis title: “A New Synthetic Route to Corrannulene”

Courses taught (\* indicates course developed):

Carleton College	<p>Chemistry 233 – Organic Chemistry I - Spring 2004, Winter 2005-2009, Fall 2008, 2010, 2016</p> <p>Chemistry 234 – Organic Chemistry II - Fall 2002, 2005, 2006, Winter 2010, 2012-2014, 2017, Spring 2013-15</p> <p>Chemistry 301 – Chemical Kinetics Laboratory – Co-taught with Prof. Trish Ferrett Fall 2012, with Prof. Daniela Kohen Fall 2014</p> <p>Chemistry 306 – Advanced Lab III: Spectroscopic Characterization of Chemical Compounds - Co-taught with Prof. Gretchen Hofmeister Spring 2004</p> <p>Chemistry 320 – Biological Chemistry - Winter 2004, Spring 2005-2012</p> <p>Chemistry 321* – Biological Chemistry Laboratory - Spring 2005-2012</p> <p>Chemistry 360* – Chemical Biology - Fall 2009</p> <p>Chemistry 400 – Comprehensive Exercise - Group exercise examining work of an invited speaker.</p> <p>Winter/Spring 2005 – Gregory Verdine, Harvard University</p> <p>Winter/Spring 2006 – Carolyn Bertozzi, University of California, Berkeley</p> <p>Winter/Spring 2007 – Ronald Breaker, Yale University</p> <p>Winter/Spring 2009 – David Tirrell, California Institute of Technology</p> <p>Winter/Spring 2010 – Ben Cravatt, The Scripps Research Institute</p> <p>Winter/Spring 2012 – Antoine van Oijen, University of Groningen</p> <p>Winter/Spring 2015 – S. Walter Englander, University of Pennsylvania</p> <p>Winter/Spring 2017 – Catherine Drennan, Massachusetts Institute of Technology</p> <p>Winter/Spring 2018 – Andrew Ellington, University of Texas, Austin</p> <p>Chemistry 400 – Comprehensive Exercise - Individual exercise. Advised students writing long research papers. 2004 (two students), 2005, 2006 (two students), 2009, 2011, 2013, 2015, 2017</p> <p>Carleton Summer Science Institute, one week course for high school students, How Drugs Work* - Summer 2013-15</p> <p>Political Science 248 – Studies in Weapons of Mass Destruction – Taught modules on chemical and biological weapons. Fall 2017</p>
Williams College	<p>Chemistry 121* – Fighting Disease: The Evolution and Operation of Human Medicines - Fall 1999, 2000</p> <p>Chemistry 202 – Organic Chemistry II - Spring 2002, Laboratory Instructor - Spring 2000, 2001, 2002</p> <p>Chemistry 310 – Enzyme Kinetics and Reaction Mechanisms - Spring 2000, 2001</p> <p>Chemistry 311 – Physical Organic Chemistry - Fall 2001</p> <p>Chemistry 201 – Organic Chemistry I - Laboratory Instructor - Fall 1999, 2000, 2001</p> <p>Chemistry 010* – The Origin of Life - Intensive four-week course - Winter 2001</p>

## Other teaching experience:

1992	Organic Chemistry Teaching Assistant, Columbia University Responsible for leading recitation and review sections.
1991-1992	Organic Chemistry Laboratory Assistant, Columbia University
1988-1989	General Chemistry Laboratory Assistant, Oberlin College

Undergraduate research students:

- Carleton College      Hannah Kennicott, '20, Jessica Makori, '19, Jacob Heath, '19, Samuel Diaz de Leon, '18, Isaac Donnell, '18, Joe Willenborg, '15, Patricia Hare, '16, Scott Erickson '14 (Pharmacy student, University of Washington), Kiera Wilhelm '15 (Graduate student, University of California, Berkeley), Brady Still '13 (M.D., University of Chicago), Jennifer Borchardt '13 (Ph.D., University of Wisconsin), Erik Olson '12 (Ph.D., Ohio State University), Katie France '12 (D.M.D., University of Pennsylvania), Musetta Steinbach '11, Michael Bonin, '11, Jeremy Grevet, '11 (M.D./Ph.D. student, University of Pennsylvania), Koua Her '13, Jonathan McMurry '09 (Ph.D., University of California, Berkeley), Eamon Flynn '09 (M.P.H., University of Minnesota), John Hanks, '09 (M.D., University of Minnesota), Jolene Mork '10 (Ph.D., M.I.T), Karen Borchert '08 (M.D., University of Minnesota), David Anderson '09 (M.D., University of Minnesota), Julia Brown '08 (Ph.D., Cornell University), Nakita Natala '09 (M.D., University of Rochester), Maraia Ener '08 (Ph.D., CalTech), Lucas Riley '09, Yirong Zhu '09 (M.D., Michigan State University), Ali Khaki '07 (M.D., University of California, San Diego), Amelia Gauger '07 (M.D., University of Iowa), Andrew Nieuwkoop '06 (Ph.D., University of Illinois), Gregory Ducker '06 (Ph.D., University of California, Berkeley), Alice Agyiri '06.
- Williams College:      Kristen LeChevet '02 (M.S. Johns Hopkins University), Alix Partnow '02 (D.V.M. University of Illinois), Alison Peet '03, Daniel Clayburgh '01 (M.D./Ph.D. University of Chicago), Marina Vivero '04, Jenica Chambers '04 (Ph.D., Duke University), Susan Levin '02 (Ph.D. University of California, San Francisco), Samantha Kim '01, Michele Pacholec '00 (Ph.D., Harvard University), Michael Hurwitz '00.

Research Support:

- 2005-2017      Howard Hughes Medical Institute Grant and Towsley Foundation Endowment at Carleton College. Stipends for one-two summer research students each year
- 2006              National Institutes of Health, Academic Research Enhancement Award (\$199,277 over three years)
- 2000-2002      Merck/AAAS Grant and Beckman Foundation Grant at Williams College. Stipends for one-two summer research students each year

Publications (\* indicates undergraduate collaborator.):

Editing activity for eliminating mischarged tRNAs is essential in mammalian mitochondria. Taru Hilander, Xiao-Long Zhou, Svetlana Konovalova, Fu-Ping Zhang, Liliya Euro, Dmitri Chilov, Matti Poutanen, Joseph Chihade, En-Duo Wang and Henna Tyynismaa. *Nucleic Acids Research*, 46, 849 (2018)

Transfer RNA: from pioneering crystallographic studies to contemporary tRNA biology. Pablo Fernández-Millán, Cédric Schelcher, Joseph Chihade, Benoît Masquida, Philippe Giegé and Claude Sauter. *Archives of Biochemistry and Biophysics*, 602, 95 (2016).

Structural modeling of tissue-specific mitochondrial alanyl-tRNA synthetase (AARS2) defects predicts differential effects on aminoacylation. Liliya Euro, Svetlana Konovalova, Jorge Asin-Cayuela, Már Tulinius, Helen Griffin, Rita Horvath, Robert Taylor, Patrick Chinnery, Ulrike Schara, David Thoburn, Anu Suomalainen, Joseph Chihade, Henna Tyynismaa. *Frontiers in Genetics*, 6, 21 (2015).

A Streamlined Molecular Biology Module for Undergraduate Biochemistry Labs. Gregory W. Muth, Joseph Chihade. *Biochemistry and Molecular Biology Education*, 36, 209 (2008).

Pre-transfer Editing by Class II Escherichia coli Prolyl-tRNA Synthetases: Role of Aminoacylation Active Site in "Selective Release" of Noncognate Amino Acids. Sanchita Hati, Brigitte Ziervogel, Julius SternJohn, Fai-Chu Wong, Maria C. Nagan, Abbey E. Rosen, Paul G. Siliciano, Joseph Chihade and Karin Musier-Forsyth, *J. Biol. Chem.*, 281, 27862 (2006).

Translocation within acceptor helix of a major tRNA identity determinant. Martha A. Lovato, Joseph W. Chihade, and Paul Schimmel, *EMBO Journal*, 20, 4846 (2001).

Origin of mitochondria in relation to evolutionary history of eukaryotic alanyl-tRNA synthetase. Joseph W. Chihade, James R. Brown, Paul Schimmel, and Lluís Ribas de Pouplana, *Proceedings of the National Academy of Sciences, U.S.A.*, 97, 12153 (2000).

Assembly of a catalytic unit for RNA microhelix aminoacylation using nonspecific RNA binding domains. Joseph W. Chihade and Paul Schimmel, *Proceedings of the National Academy of Sciences, U.S.A.*, 96, 12316 (1999).

Strong Selective Pressure to Use G:U to Mark an RNA Acceptor Stem for Alanine. Joseph W. Chihade, Kathleen Hayashibara, Kiyotake Shiba, and Paul Schimmel, *Biochemistry*, 37, 9193 (1998).

Single Nucleotide Modulation of the Uridine to Pseudouridine Rearrangement in Transfer RNA Catalyzed by Pseudouridine Synthase I. Joseph W. Chihade and David A. Horne, *Journal of Molecular Recognition*, 9, 524 (1996).

#### Invited talks:

Unique features of human mitochondrial alanyl-tRNA synthetase and connections to human disease, IUBMB Focused Meeting on the Aminoacyl-tRNA Synthetases, Clearwater, FL, October 31, 2017

Human mitochondrial alanyl-tRNA synthetases – ‘bizarre’ enzymes for ‘bizarre’ tRNAs, IBMC, University of Strasbourg, France, April 8, 2016

Human mitochondrial alanyl-tRNA synthetase – an eccentric housekeeper, Emory University, Jan. 21, 2015

Searching for Filarial Aminoacyl-tRNA Synthetases: A bioinformatics project for high school students, American Society for Biochemistry and Molecular Biology annual meeting, San Diego, CA, April 27, 2014

Biochemical Characterization of Pathogenic Mutations in Human Mitochondrial tRNA<sup>Ala</sup> And Alanyl-tRNA Synthetase, American Society for Biochemistry and Molecular Biology annual meeting, San Diego, CA, April 23, 2012

Piecing together a molecular puzzle. Mitochondrial Alanyl-tRNA Synthetases, St. Olaf College, Oct. 15 2010

What We Can Learn From Outliers: Mitochondrial Alanyl-tRNA Synthetases, University of Arizona, Oct. 18, 2008

A Research Style Biochemistry Lab: Collaborating on the Integration of Research and Teaching at Two Institutions. Feb. 24, 2007, Pew Midstates Consortium Workshop – Interdisciplinary Science Education, St. Olaf College

Animal Mitochondrial Alanyl-tRNA Synthetases Use Divergent tRNA Recognition Strategies. 2006 International Conference on Aminoacyl-tRNA Synthetases. Oct. 3, 2006, San Diego, CA

Substrate Specificity of Mitochondrial Alanyl-tRNA Synthetases - Weird tRNAs Meet the Second Genetic Code. Macalester College, Feb. 15, 2006

Mitochondrial Alanyl-tRNA Synthetases: Diverse Recognition Strategies for Diverse tRNAs. 21<sup>st</sup> International tRNA Workshop. Dec. 4, 2005, Bangalore, India

Assembly of a catalytic unit for microhelix aminoacylation using nonspecific RNA binding domains. 18<sup>th</sup> tRNA Workshop. April 10, 2000. Cambridge, UK

Poster presentations (\* indicates undergraduate collaborator.):

Characterization of pathogenic mutations in human mitochondrial alanyl-tRNA synthetase, Hannah Kennicott\*, Jessica Makori\*, Samuel Diaz de Leon\*, Isaac Donnell\*, Jacob Heath\*, and Joseph Chihade, American Society for Biochemistry and Molecular Biology annual meeting, San Diego, CA, April 2018.

Searching for Filarial Aminoacyl-tRNA Synthetases: A bioinformatics project for high school students, Kiera Wilhelm\*, Scott Erickson\*, and Joseph Chihade, American Society for Biochemistry and Molecular Biology annual meeting, San Diego, CA, April 2014.

Characterization of helminth aaRS sequences, Kiera Wilhelm\*, Scott Erickson\*, and Joseph Chihade, 9th International Symposium on Aminoacyl-tRNA Synthetases, Hakone, Japan, October 2013.

Using in-line probing to characterize pathogenic mutations in human mitochondrial tRNAs, Brady Still\*, Koua Her\*, Joseph Chihade, American Society for Biochemistry and Molecular Biology annual meeting, April, 2013 Boston, MA.

Understanding the basis of pathogenicity in the R592W mutant of human mitochondrial alanyl-tRNA synthetase, Jennifer Borchardt\*, Katherine France\*, Joseph Chihade, American Society for Biochemistry and Molecular Biology annual meeting, April, 2013, Boston, MA.

Biochemical Characterization of Pathogenic Mutations in Human Mitochondrial tRNA<sup>Ala</sup> And Alanyl-tRNA Synthetase. Koua Her\*, Musetta Steinbach\*, Katie France\*, Erik Olson\*, Joseph Chihade American Society for Biochemistry and Molecular Biology annual meeting, April, 2012, San Diego, CA.

Human Mitochondrial Alanyl-tRNA Synthetase. Joseph Chihade, Koua Her\*, Michael Bonin\*, Musetta Steinbach\*, Katie France\*, International Symposium on Aminoacyl-tRNA Synthetases, September, 2011, Snowbird, UT.

Metazoan mitochondrial alanyl-tRNA synthetases – varying roles for a C-terminal domain. David Anderson\*, Julia Brown\*, Karen Borchert\*, Jeremy Grevet\*, A. Jolene Mork\*, Nakita Natala\*, Yirong Zhu\*, Joseph Chihade. American Society for Biochemistry and Molecular Biology Annual Meeting. April 2010, Anaheim, CA

Research based biochemistry laboratory: A modular approach. Gregory Muth and Joseph Chihade. Student Centered Education in Biochemistry and Molecular Biology, Aug. 2009, Colorado Springs, CO.

Human mitochondrial alanyl-tRNA synthetase: gaining insight from an outlier. David Anderson\*, Julia Brown\*, Karen Borchert\*, John Hanks\*, Jonathan McMurry\*, A. Jolene Mork\*, Nakita Natala\*, Joseph Chihade. International Conference on Aminoacyl-tRNA Synthetases, Sept. 2008, Annecy, France.

Human mitochondrial alanyl-tRNA synthetase: A variant mode of tRNA recognition. Karen Borchert\*, David Anderson\*, Nakita Natala\*, Yirong Zhu\*, Lucas Riley\*, Maraia Ener\*, Julia Brown\*, Joseph Chihade. American Society for Biochemistry and Molecular Biology Annual Meeting, April 2008, San Diego, CA and American Chemical Society National Meeting, April 2008, New Orleans, LA.

RNA recognition strategies of metazoan mitochondrial alanyl-tRNA synthetases. Thayne Dickey\*, Ali Khaki\*, Amelia Gauger\*, and Joseph W. Chihade, American Society for Biochemistry and Molecular Biology Annual Meeting. April 2007, Washington, DC

Unusual Basis of tRNA<sup>Ala</sup> Identity in Human Mitochondria. Ali Khaki\*, Thayne Dickey\*, Amelia Gauger\*, Alice Agyiri\*, and Joseph Chihade. 2006 International Conference on Aminoacyl-tRNA Synthetases. Oct. 2006 San Diego, CA

Mitochondrial alanyl-tRNA synthetases suggest a role for a previously uncharacterized C-terminal domain. Andrew Nieuwkoop\*, Gregory Ducker\*, and Joseph W. Chihade. American Chemical Society National Meeting, Aug. 2005. Washington, DC

Human mitochondrial tRNA<sup>Ala</sup> has unique identity elements. Amelia Gauger\*, Ali Khaki\*, and Joseph W. Chihade. American Chemical Society National Meeting, Aug. 2005. Washington, DC

The basis of mitochondrial alanine tRNA identity is species specific. Joseph Chihade, Michelle Pacholec\*, Daniel Clayburgh\*, Alix Partnow\*, Alice Agyiri, Andrew Nieuwkoop, Gregory Ducker. International Conference on Aminoacyl-tRNA Synthetases, July 2004. Seoul, South Korea

Animal mitochondrial alanyl-tRNA synthetases: Unusual recognition of unusual substrates. Joseph Chihade, Michelle Pacholec\*, Daniel Clayburgh\*, Alix Partnow\* Nucleic Acids Gordon Research Conference, June 2003, Newport, RI

Point Mutation in Yeast Pseudouridine 55 Synthase Causes a Temperature-Sensitive Phenotype. J.W. Chihade, S. Levin\*, A. Peet\*, and W. Raymond. Sixth Annual Meeting of the RNA Society, May 2001, Banff, Canada.

### Service and Professional Activities:

Carleton College

#### Major roles:

Faculty co-chair of Community Equity and Diversity Initiative 2017-present

Chair of Chemistry Department 2016-present

Director of Biochemistry Concentration 2006-2015, 2016-present

Faculty liaison for Science Facilities planning 2014-2015

Co-chair of Science Facilities Master Planning working group, 2013-2014

Campus-wide Facilities Master Planning working group, 2013-2014

Director of the Carleton Interdisciplinary Science and Math Initiative, HHMI Program

Director, and Math/Science Steering Board co-chair. 2010-2013

Associate Cismi and HHMI program director, 2009-2010 and 2013-present

College Curricular Design Team 2007

#### Other work:

Community Equity and Diversity Initiative, 2016-2017

Benefits Committee 2010-2013

Institutional Review Board 2009-2010

Community Equity and Diversity Initiative Taskforce on Learning Outside the Classroom 2009-2010

Presidential Taskforce on Childcare 2008-2009

Institutional Animal Care and Use Committee 2008-2011

Pre-health Advisory Committee 2007-present

Academic Computing Advisory Committee 2005-2008

Williams College

Winter Study Committee 2001-2002

Chemistry Department Representative to Divisional Research Funding Committee 2000-2001

Biochemistry and Molecular Biology Program Committee 1999-2002

Other

Outside Honors Examiner, Oberlin College, May 2006

Manuscript and proposal review for Analytical Biochemistry, Biochemistry, Nature Chemical Biology, Nucleic Acids Research, Oxford University Press, Prentice Hall, Wiley, and the National Science Foundation

Tenure, promotion and pre-tenure reviews

Biochemistry program review at Union College, Winter 2015

Honors and Awards:

National Institutes of Health, Post-doctoral Fellowship, 1997-1999.

Sylvia and Victor G. Fourman Fellowship Award, Columbia Univ., 1994-1995.

NIH Trainee, Training Program in Molecular Biophysics, Columbia Univ. 1992-1993.

Honors Degree, Oberlin College, 1989.

Sigma Xi Honor Society, Oberlin College, 1989.

Professional affiliations:

American Society for Biochemistry and Molecular Biology

American Chemical Society

American Association for the Advancement of Science

The RNA Society

Council on Undergraduate Research

Sigma Xi, The Scientific Research Society