

Tyler P. Roche

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EDUCATION

Doctor of Philosophy, Chemistry and Biochemistry expected 2021

Graduate Certificate in Astrobiology

Georgia Institute of Technology, Atlanta, GA

PI: Nicholas V. Hud

Current work: Prebiotic Relevance of Ketose Sugars to the Origin of Aldose Ribo-Nucleosides

Graduate Study, Earth Sciences 2012–2014

University of Southern California, Los Angeles, CA

PI: Jan P. Amend

Completed 34 units of Graduate Study in Earth, Biological, and Ocean Sciences

Bachelor of Arts, Molecular Biology 2012

Pomona College, Claremont, CA

PI: Clarissa M. Cheney

Thesis: Function of N-Terminal Acetylation in GDI

RESEARCH EXPERIENCE

Graduate Research Assistant, Georgia Institute of Technology, Atlanta, GA 2017–present

PI: Nicholas V. Hud

- Assessed reactivity of prebiotic nucleobases with a variety of electrophiles
- Investigated isomerization of sugars in aqueous solutions and their reactions with prebiotic nucleobases
- Developed expertise in ^1H and ^{13}C NMR (1D and 2D), and in LC-MS and UV-based analysis of polar and nonpolar compounds
- Contributed to SOPs for above analytical procedures as well as producing code for data-processing programs

Graduate Research Assistant, University of Southern California, Los Angeles, CA 2012–2014

PI: Jan P. Amend

- Cultivated *Archaeoglobus fulgidus* in anaerobic systems, including use of an anaerobic glove box, media preparation, and microscopic analysis
- Gained experience in cultivating microbes in chemostat fermenter systems, focusing on growth rate and steady-state in- and outflow

Undergraduate Researcher, Pomona College, Claremont, CA 2011–2012

PI: Clarissa M. Cheney

- Investigated protein modification and its role in development in *Drosophila melanogaster*
- Maintained multigenerational *Drosophila* genetic lines, including obtaining trait-linked modifications to specific genes
- Designed DNA primer sequences for bacterial plasmid creation and cloning using *Escherichia coli* transformation techniques

- Utilized analytical techniques including western blots, fluorescence microscopy, and PCR to detect changes to *Drosophila* proteins post-modification

Research Intern, Saban Research Institute, Los Angeles, CA

2010

PI: David Warburton

- Investigated the effects of amniotic fluid stem cells on induced lung fibrosis in living systems (mice), resulting in a publication (*see below*)
- Performed genotypic analysis using DNA extraction and rt-PCR amplification
- Contributed to lung fixing and sectioning for organ damage observation

TEACHING EXPERIENCE

Teaching Assistant, University of Southern California, Los Angeles, CA

2012–2013

GEOL 150: Climate Change

- Conducted lab- and revision-style sections for lecture-based course on climate change
- Implemented activities and lessons designed specifically for the non-major students, aiming to increase engagement and interest in the topic
- Taught 2-hour sections of 20–25 students new and review material
- Designed, proctored, and graded quizzes and further assessments
- Held office hours resulting in multiple one-on-one review sessions with students

Teaching Assistant, Georgia Institute of Technology, Atlanta, GA

2017–2018

CHEM 2211: Quantitative Analysis with Laboratory

- Responsible for aiding in adaptation of laboratory courses for undergraduate students
- Taught 4.5-hour sections of laboratory work including demonstration
- Responsible for safety measures and proper handling protocols for various chemical materials
- Contributed to ongoing development of automated grading system using digital spreadsheets
- Engaged in one-on-one teaching in office hours

LEADERSHIP EXPERIENCE

Secretary, ExplOrigins Executive Board, Georgia Institute of Technology

2021–2022

- Contributed to maintenance of the Georgia Tech Astrobiology website (<https://astrobiology.gatech.edu>) and ExplOrigins sub-page
- Maintained active roster and took meeting minutes
- Acted as a member of the ExplOrigins executive board to coordinate multiple events including socials, public talks, and the annual ExplOrigins Colloquium

Chair, Gordon Research Seminar (GRS): Origins of Life

2020–2022

- Selected as one of two co-chairs to organize the next Origins of Life GRS, an early-career supplement to the Origins of Life Gordon Research Conference (GRC)
- Responsible for obtaining funding, creating a title, theme, description, and planned schedule for the conference
- Will be soliciting, refereeing, and selecting abstracts to be presented as talks and posters at the GRS

Social Chair, Leadership and Outreach Committee, Center for Chemical Evolution (CCE)

2018–2020

- Organized and executed social events to promote community and teambuilding among members of the CCE

- Planned and executed combined outreach/social events including trivia nights and demo booths as part of the Atlanta Science Festival

External Organizer, Astrobiology Graduate Conference, Salt Lake City, UT

2019

- Organized and carried out a Proposal Writing Retreat, managing curriculum and hosting 20–30 students
- Planned logistics for food, lodging, and scheduling for the retreat, including sorting applicants and constructing viable teams
- Aided students in proposal writing challenge in real-time, including sourcing information, providing guidance, and judging completed proposals

OUTREACH EXPERIENCE

Center for Chemical Evolution, Georgia Institute of Technology

2017–2020

Aided in the creation and implementation of both science demonstrations and media activities aimed at engaging students of various ages in the fields of astrobiology and STEAM

Events:

- Dekalb County Library Evening of Wonder
- Hands on Future Tech
- Atlanta Science Festival
- Mableton Middle School STEAM Night

PUBLICATIONS

1. L. E. Rodriguez, T. Altair, N. Y. Hermis, T. Z. Jia, **T. P. Roche**, L. H. Steller, J. M. Weber. Chapter 4: A Geological and Chemical Context for the Origins of Life on Early Earth, in *Astrobiology Primer 3.0* special issue, edited by M. Schaible, N. Szeinbaum, and G. Tan. *Astrobiology*, in revision.
2. D. M. Fialho, **T. P. Roche**, N. V. Hud. Prebiotic Syntheses of Noncanonical Nucleosides and Nucleotides. *Chem. Rev.* **120**, 4806–4830 (2020).
3. O. Garcia, G. Carraro, G. Turcatel, M. Hall, S. Sedrakyan, **T. Roche**, S. Buckley, B. Driscoll, L. Perin, D. Warburton. Amniotic fluid stem cells inhibit the progression of bleomycin-induced pulmonary fibrosis via CCL2 modulation in bronchoalveolar lavage. *PLOS ONE* **8**(8): e71679 (2013).

SCIENTIFIC POSTERS AND PRESENTATIONS

1. **T. P. Roche**, D. M. Fialho, C. Menor Salván, R. Krishnamurthy, G. B. Schuster, N. V. Hud. Robust Ribonucleosides: A Pathway to Ribose from Simple Sugars via Ketose Intermediates. AbGradCon (2021) Virtual, (<https://www.youtube.com/watch?v=fVZaOfYDK7Q>)
2. **T. P. Roche**, D. M. Fialho, C. Menor Salván, R. Krishnamurthy, G. B. Schuster, N. V. Hud. Ketoses: The Key to Prebiotic Nucleoside Formation? Prebiotic Chemistry and Early Earth. Environments Seminar Series (2021), Virtual (<https://www.youtube.com/watch?v=xwOHUG1WSDc>)
3. **T. P. Roche**, D. M. Fialho, C. Menor-Salván, R. Krishnamurthy, G. B. Schuster, N. V. Hud. Origins of Life: What Role did Sugars Play? ExplOrigins Colloquium (2021), Georgia Institute of Technology, Atlanta, GA (Poster)
4. **T. P. Roche**, D. M. Fialho, G. B. Schuster, N. V. Hud. Prebiotic Relevance of Ketose Sugars to the Origin of Aldose Nucleosides. American Chemical Society Spring Meeting (2020), Virtual (Digital Slide Presentation)

5. **T. P. Roche**, D. M. Fialho, G. B. Schuster, R. Krishnamurthy, N. V. Hud. Robust Ribonucleosides: A Pathway to Ribose from Simple Sugars via Ketose Intermediates. Gordon Research Conference: Origins of Life (2020), Galveston, TX (Poster, also presented at ExplOrigins Colloquium 2020)
6. **T. P. Roche**, D. M. Fialho, G. B. Schuster, R. Krishnamurthy, N. V. Hud. Prebiotic Relevance of Ketose Sugars to the Origin of Aldose Nucleosides. Astrobiology Science Conference (2019), Bellevue, WA (Oral Presentation)
7. **T. P. Roche**, D. M. Fialho, G. B. Schuster, R. Krishnamurthy, N. V. Hud. Solving the Ribose Problem: Ketose Interconversion is Key. Center for Chemical Evolution Annual Meeting (2019), Chattanooga, TN (Poster)
8. **T. P. Roche**, D. M. Fialho, G. B. Schuster, R. Krishnamurthy, N. V. Hud. Sugars and the Origin of Life: Unlocking Ribose with Ketose Sugars. ExplOrigins Colloquium (2019), Georgia Institute of Technology, Atlanta, GA (Poster)
9. D. M. Fialho, **T. P. Roche**, G. B. Schuster, R. Krishnamurthy, N. V. Hud. Synthesis and Self-Assembly of Noncanonical Nucleotides in Water: The Origin of Primitive Genetic Polymers. Center for Chemical Evolution Annual Meeting (2018), Georgia Institute of Technology, Atlanta, GA (Poster)
10. **T. P. Roche**, D. M. Fialho, R. Krishnamurthy, N. V. Hud. The Condensation of a Model Proto-RNA Nucleobase with Ribulose: A Prebiotic Pathway to RNA. Astrobiology Graduate Conference (2018), Georgia Institute of Technology, Atlanta, GA (Poster, updated from below)
11. **T. P. Roche**, D. M. Fialho, R. Krishnamurthy, N. V. Hud. The Condensation of a Model Proto-RNA Nucleobase with Ribulose: A Prebiotic Pathway to RNA. Georgia Tech Astrobiology Colloquium (2018), Atlanta, GA (Poster)

AWARDS, FELLOWSHIPS, AND HONORS

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| • <u>William Emerson Outstanding Second Year Seminar Award</u>
<i>Georgia Institute of Technology—School of Chemistry & Biochemistry</i> | 2018 |
| • <u>Best Group Proposal</u>
<i>AbGradCon 2018 Proposal Writing Retreat</i> | 2018 |
| • <u>President's Fellowship</u>
<i>Georgia Institute of Technology</i> | 2017–present |
| • <u>Provost's Ph.D. Fellowship</u>
<i>University of Southern California</i> | 2012–2014 |
| • <u>Georgia Tech Astrobiology Fellowship</u>
<i>Georgia Institute of Technology—College of Sciences Sutherland Dean's Chair</i> | 2021 |