Zachary Adam *Curriculum Vitae*

University of Arizona, Lunar and Planetary Laboratory
Kuiper Space Sciences Building, Room 241
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PROFESSIONAL PREPARATION

Ph.D. 2014, Montana State University, Earth Sciences
Dissertation title: Microfossil paleontology and biostratigraphy of the early Mesoproterozoic Belt Supergroup, Montana

M.Sc. 2006, University of Washington, Aeronautics and Astronautics Engineering
Thesis title: Actinides and the Origins of Life

B.Sc. 2004, University of Washington, Earth and Space Sciences

B.Sc. 2004, University of Washington, Aeronautics and Astronautics Engineering

ACADEMIC AND PROFESSIONAL APPOINTMENTS

2018 Associate Staff Scientist, University of Arizona, Lunar and Planetary Laboratory
2017 Simons Origins of Life Postdoctoral Fellow, Harvard University, group of Dr. Andrew Knoll
2014 Agouron Institute Postdoctoral Fellow, Harvard University, group of Dr. Andrew Knoll
2010 Director, Blue Marble Space, www.bluemarblespace.org
2008 Representative, NASA Advisory Council, Subcommittee on Planetary Protection
2008 Associate Member, NASA/FAA/DOD Launch Vehicle Range Safety Group
2007 Aerospace Engineer, FAA Office of Commercial Space Transportation; licensing officer for SpaceX (Falcon 1, Falcon 9 and Dragon) and Boeing (Zenit-3SL) missions

SELECTED AWARDS AND HONORS

2021 John Templeton Foundation, Research Grant, Science of Purpose, Collaborator
2021 John Templeton Foundation, Ideas Challenge Award Recipient
2017 Harvard University Certificate of Distinction in Teaching, Bok Center
2017 Arizona State University Origins Project Postdoctoral Lectureship
2017 Simons Collaboration on the Origins of Life Postdoctoral Fellowship
2016 ELSI Origins Network Origins of Life Seed Grant Award, Co-I
2016 NASA Astronaut Corps Class of 2017 Selection Finalist
2014 Agouron Institute Geobiology Postdoctoral Fellowship
2013 NASA Astrobiology Institute, Early Career Collaboration Award
2012 Tobacco Root Geological Society, Harrison Scholarship
2012 Belt Association Research Grant Award
2012 Donald L. Smith Memorial Fund for Field Geology Research
2011 National Science Foundation, Graduate Research Fellowship Program (GRFP) Recipient
2011 NASA Astrobiology Institute Lewis and Clark Fund for Exploratory Research Award
2011 Teachers Without Borders, International Fellowship Award
2011 PARSA Community Foundation Award for Geoscience Education

2010 National Science Foundation, IGERT Program Recipient, Montana State University

2010 Geological Society of America, Reviewer of the year for *GSA Today*

2009 American Chemical Society, Reviewer of the year for *Chemical Review*

PUBLICATIONS

Adam, Z.R., Fahrenbach, A., Jacobson, S.M., Kacar, B. and Zubarev, D.Yu. (2021). Radiolysis Generates a Complex Organosynthetic Chemical Network. *Scientific Reports,* vol. 11, no. 1743, doi: 10.1038/s41598-021-81293-6.

Tran, Q.P., **Adam, Z.R**., and Fahrenbach, A.C. (2020) Prebiotic Reaction Networks in Water. *Life,* vol. 10, no. 12, doi: 10.3390/life10120352.

Yi, R., Tran, Q.P., Yoda, I., **Adam, Z.R**., Cleaves, H.J. and Fahrenbach, A.C. (2020) A continuous reaction network that produces RNA precursors. *PNAS,* vol. 117, no. 24, doi: 10.1073/pnas.1922139117.

Adam, Z.R., Kacar, B., Som, S.M., Lynch, K.L., Walther-Antonio M. and Williford, K.H. (2018). The origin of animals as microbial host volumes in nutrient-limited seas. *PeerJ Preprints,* vol. 6, e27173v1.

Yi, R., Hongo, Y., Yoda, I., **Adam, Z.R.** and Fahrenbach, A. (2018). Radiolytic synthesis of cyanogen chloride, cyanamide and simple sugar precursors. *ChemistrySelect,* vol. 3, no. 36, pp. 10169-10174.

Adam, Z.R., Fahrenbach, A., Hongo, Y., Cleaves, H.J., Yi, R., Yoda, I. and Aono, M. (2018). Estimating the capacity for production of formamide by radioactive minerals on the prebiotic Earth. *Scientific Reports,* vol. 8, no. 1, p. 265.

Adam, Z.R., Fahrenbach, A., Kacar, B. and Aono, M. (2018). Prebiotic geochemical automata at the intersection of radiolytic chemistry, physical complexity and systems biology. *Complexity,* article 9376183, doi: 10.1155/2018/9376183.

Adam, Z.R., Mogk, D.W., Skidmore, M.L. and Butterfield, N.J. (2017). A Laurentian record of the earliest fossil eukaryotes. *Geology,* vol. 45, no. 5, doi: 10.1130/G38749.1.

Adam, Z.R., Zubarev, D., Aono, M., Cleaves, H.J. (2017). Subsumed complexity: Abiogenesis as a byproduct of complex energy transduction. *Philosophical Transactions of the Royal Society A*, v. 375, no. 2109, p. 20160348.

Kacar, B, Hanson-Smith, V., **Adam, Z.R.** and Boekelheide, N. (2017). Constraining the timing of the Great Oxidation Event within the Rubisco phylogenetic tree. *Geobiology,* vol. 15, no. 5, pp. 628-640.

Adam, Z.R., Skidmore, M.L., and Mogk, D.W, 2016. Paleoenvironmental implications of an expanded microfossil assemblage from the Chamberlain Formation, lower Belt Supergroup, Montana. GSA Special Paper no. 522- Belt Supergroup: Window to Proterozoic Earth.

Adam, Z.R., 2016. Temperature oscillations near natural nuclear reactor cores and the potential for prebiotic oligomer synthesis, *Origins of Life and Evolution of Biospheres,* v. 46, no. 2, pp. 171-187.

Adam, Z., DeMarines, J., Illangkoon, H., Kaçar, B., Som, S. and Walker, S.I., 2012. Integrating Mentoring in a Social Network Setting with the S.A.G.A.N. Mentorship Program. *Proceedings of the 2012 Mentoring Conference*.

Adam, Z.R., 2010. Environmental Control and Life Support Systems for Flight Crew and Space Flight Participants in Suborbital Space Flight. Advisory Circular AC460.11-1-A, published by the Office of Commercial Space Transportation, Federal Aviation Administration, Washington, DC.

Som, S.M., **Adam, Z.R.,** and Vance, S., 2009. Use the Water: In-Situ Resource Technology for Icy-Surface Landers. *Acta Astronautica*, v. 64, no. 9, pp. 1006-1010.

Adam, Z.R., 2009. Evidence of Gravitons as Fused Photons in Four Dimensions. ArXiv, no. 0902.0178.

Adam, Z.R., 2007. Actinides and Life's Origins, *Astrobiology,* v. 7, no. 6, pp. 852-872.

PEER-REVIEWED GOVERNMENT REPORTS (not for public release)

Adam, Z. R., 2009, Analysis of SpaceX Falcon 9 second stage survivability for Flight 001 during Africa overflight and Bermuda near-overflight: Federal Aviation Administration, Office of Commercial Space Transportation, AST-200, 9 pages.

Adam, Z.R., 2009, Analytical development of the SpaceX Dragon reentry vehicle debris list: Federal Aviation Administration, Office of Commercial Space Transportation, AST-200, 15 pages.

Adam, Z.R., 2009, Analytical solution for expected casualty resulting from a SpaceX Dragon random, uncontrolled reentry: Federal Aviation Administration, Office of Commercial Space Transportation, AST-200, 4 pages.

Adam, Z.R., 2009, Probability of failure analysis for the SpaceX Dragon demonstration reentry flights: Federal Aviation Administration, Office of Commercial Space Transportation, AST-200, 11 pages.

CURRICULUM GUIDES

Adam, Z.R., 2012. Teacher's Guide to Space Technology for Disaster Management, 105 pages.
Mohadjer, S. and **Adam, Z.R.,** 2010. Teacher's Guide to Earthquake Safety Education, 118 pages.

RECENT INVITED TALKS

2020 "Complex Network Topology of a Prebiotic Organosynthetic System", Gordon Research Conference on the Origins of Life, Galveston, TX.
2019 "Radiolysis Generates a Complex Chemical Network with Life-like Organizational Attributes", Harvard Origins Initiative Special Seminar and Annual Faculty Dinner, Cambridge, MA.
2019 "Network Topology of Radiolytic Chemical Systems that Generate Ribonucleotide Precursors", NASA Astrobiology Science Conference, Seattle, WA.
2017 "Production and Concentration of Water-Alternative Solvents on the Prebiotic Earth", NASA Astrobiology Conference, Phoenix, AZ.
2017 "New Views of the Complex Eukaryote *Tappania Plana* from the 1.4Ga Belt Supergroup", NASA Astrobiology Conference, Phoenix, AZ.
2017 "A Theoretical Architecture for Exploring Organic Automata and the Origins of Life", Origins Project, Arizona State University, Tempe, AZ.
2016 "A Laurentian record of the earliest fossil eukaryotes: A search image for the Mars2020 mission", NASA JPL Planetary Science Seminar, Pasadena, CA.
2016 "Evidence of sexual conjugation and crown-group status in early Proterozoic eukaryotes, GSA National Meeting, Boulder, CO.
2016 "A Laurentian record of the earliest fossil eukaryotes", Northeast Geobiology Symposium, Harvard University, Cambridge, MA.

2015 "Microfossils from the Belt Supergroup, Montana: A new window into early eukaryote evolution", NASA Astrobiology Science Conference, Chicago, IL, June.
2015 "Coupled thermodynamic feedback and organic synthesis in natural nuclear reactors", Earth-Life Sciences Institute, Tokyo Institute of Technology, Japan, May.
2015 "Natural nuclear reactors as a case study for coupled thermodynamic feedback and organic synthesis in geological systems", Harvard Origins of Life Initiative, April.
2014 "Microfossils from the Greyson Formation, Lower Belt Supergroup: Support for Early Mesoproterozoic Biozonation", GSA Rocky Mountain/Cordilleran Joint Meeting, Montana.
2014 "Astrobiology and the search for complex life", Georgia Tech Planetary Seminar Series, Atlanta, GA, February.
2013 "Microfossils and the Mesoproterozoic Rise of Complexity", University of Washington Astrobiology Colloquium, Seattle, WA, November.
2013 "Two paths, one destination: Integrating fossil data into genetic sequence models to investigate the origin of eukaryotes", Matematiksel Evrim Symposium, Sirince, Turkey, June.
2013 "A case for 1.4 billion year old dimorphic fungi: New views on the early evolution of eukaryotes", World Summit on Evolution III, San Cristobal, Galapagos, June.

TEACHING EXPERIENCE

University of Arizona

MCB195- Microbiology of Star Trek, Guest lecturer, 2020, 2021.
MCB495- History of Life on Earth, Guest lecturer, Spring 2021.
ASTR202- Life in the Universe, Guest lecturer, Fall 2018.

Harvard University

EPS/OEB 56- A History of Life on Earth, Teaching Fellow, Spring 2017.
Historical Geobiology- Mass Extinctions, Guest lecturer, Fall 2014.

GSA Field Trip Guide

GSA Trip 408: Mesoproterozoic tectonics and sedimentation along the southern margin of the Belt Basin, May 2014.

Georgia Tech

Introduction to Evolution, Guest lecturer, Spring and Fall 2013.

Aga Khan Schools

Earthquake science and preparedness training for school teachers and administrators, Shughnan, Tajikistan and Badakhshan, Afghanistan, 2011; Gujarat, India 2012.

PUBLIC EDUCATION AND OUTREACH

2017 Energy, Entropy and Complexity on the Prebiotic Earth, Arizona State University, Tempe, AZ
2016 PBS television series Science for the Public, interview guest, Belmont, MA
2016 Brcko Night of Science public science seminar, invited speaker, Brcko, Bosnia
2014 The Scientist Is In, Smithsonian Museum of Natural History, Washington, DC
2013 Astrobiology Mentor for At-Risk Teens, Pittsburg Community School, Pittsburg, CA
2013 Astrobiology and Paleobiology Guest Lecturer, Hellgate High School, Missoula, MT
2013 Co-founder, SAGANet (Social Action for a Grassroots Astrobiology Network, saganet.org)
2012 Student Earthquake Education, Aga Khan Schools, Gujarat, India
2011 Student Earthquake Education, Public and Aga Khan Schools, Dushanbe, Tajikistan, Khorog, Tajikistan, and Shughnan, Afghanistan
2010 Co-founder, Blue Marble Space Institute of Science (www.bmsis.org)
2010 "Can Earthquakes Be Predicted?" MIT Blossoms online course offering