

Rogier Braakman

Department of Civil and Environmental Engineering
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Research Interests:

Metabolic Evolution, Microbial Ecology and Evolution, Biogeochemistry, Geobiology, Earth History, Macroevolution and Biodiversity, Systems Biology, Biochemistry, Origin of Life

Education:

PhD Chemical Physics, Caltech 2010
MSc Chemistry, *Cum Laude*, University of Amsterdam 2003

Experience:

Postdoc, *Microbial Oceanography, Ecology and Evolution*, CEE & EAPS, MIT 2013 – current
Postdoc, *Metabolic Evolution & Origin of Life*, the Santa Fe Institute 2009 – 2013
Graduate Researcher, *Astrochemistry*, Dept. of Chemistry, Caltech 2003 – 2009
Research Assistant, *Astrochemistry*, Dept. of Astronomy, Leiden University 2001

Visiting Positions:

Visiting Researcher, *Hyperthermophile Microbiology & Systems Biology*, IMCS, Rutgers University 2013
Regular Visiting Researcher, *Systems Biology*, Program for Bioinformatics, Boston University 2011 – 2012
Visiting Graduate Fellow, *Origin of Life*, the Santa Fe Institute 2008, 2009
Visiting Graduate Student, *Astrochemistry*, Dept. of Chemistry, Caltech 2002 – 2003

Honors and Awards:

Martin and Beate Block Award, 'Populations, Evolution and Physics' conference, Aspen Center for Physics 2016
Simons Foundation Fellow of the Life Sciences Research Foundation 2014 – 2017
Charles King Trust Fellowship, the Medical Foundation, MA (declined) 2014 – 2016
Omidyar Fellow, the Santa Fe Institute 2010 – 2013
'Quantitative Laws of Genome Evolution' workshop participant and travel award 2013
Astrobiology Graduate Conference oral presentation and travel award 2012
International Astronomy Union 'Molecular Universe' conference travel award 2011
Santa Fe Institute Complex Systems Summer School (in Beijing) participant and travel award 2006
Association of Dutch Chemical Industry award (prize to top 30 1st-year chemistry students in the Netherlands) 1998

Publications:

<https://scholar.google.com/citations?user=gzla8vQAAAAJ&hl=en>

- R. Braakman, M.J. Follows & S.W. Chisholm, "Metabolic evolution and the self-organization of ecosystems", *Proceedings of the National Academies of Sciences USA* 114, *E3091-3100* (2017)
- R. Braakman & E. Smith, "Metabolic evolution of a deep-branching hyperthermophilic chemoautotrophic bacterium", *PLOS One* 9, e87950 (2014)
- R. Braakman, "Mapping metabolism onto the prebiotic chemistry of hydrothermal vents", *Proceedings of the National Academies of Sciences USA* 110, *13236-13237* (2013)
- R. Braakman & E. Smith, "The compositional and evolutionary logic of metabolism", *Physical Biology* 10, 011001 (2013)
- R. Braakman & E. Smith, "The emergence and early evolution of biological carbon-fixation", *PLoS Computational Biology* 8, e2002455 (2012)
- R. Braakman & G.A. Blake, "Principles and promise of Fabry-Perot resonators at THz frequencies", *Journal of Applied Physics* 109, 063102 (2011)

- R. Braakman, A. Belloche, G.A. Blake, K. Menten, "Search for interstellar methoxyacetonitrile and cyanoethanol: insights into coupling of cyano- to methanol and ammonia chemistry", *The Astrophysical Journal* 724, 994-1005 (2010)
- R. Braakman, B.J. Drouin, S.L. Widicus, G.A. Blake, "Extended analysis of hydroxyacetone in the torsional ground state", *Journal of Molecular Spectroscopy* 264, 43-49 (2010)
- R. Braakman, G.A. Blake, "The millimeter-wave spectrum of 2-cyanoethanol", *Journal of Molecular Spectroscopy* 262, 100-106 (2010)
- R. Braakman, G.A. Blake, "The millimeter-wave spectrum of methoxyacetonitrile", *Journal of Molecular Spectroscopy* 262, 93-99 (2010)
- L.-H. Xu, J. Fisher, R.M. Lees, H.Y. Shi, J.T. Hougen, J.C. Pearson, B.J. Drouin, G.A. Blake, R. Braakman, "Torsion-rotation global analysis of the first three torsional states ($v_t = 0,1,2$) and terahertz database for methanol", *Journal of Molecular Spectroscopy* 251, 305-313 (2008)
- S. L. Widicus, R. Braakman, D. R. Kent, IV, G. A. Blake, "The millimeter and submillimeter rotational spectrum of 1,3-dihydroxyacetone", *Journal of Molecular Spectroscopy* 224, 101-106 (2004)
- F. F. S. van der Tak, A. M. S. Boonman, R. Braakman, E. F. van Dishoeck, "Sulphur chemistry in the envelopes of massive young stars", *Astronomy and Astrophysics* 412, 133-145 (2003)

Seminars and Invited Talks:

ELSI International Symposium, Earth-Life Science Institute, Tokyo Tech (upcoming)	1/18
Center for Mechanisms of Evolution, Arizona State University (upcoming)	1/18
Guest Lecture, Simons Collaboration on the Origin of Life annual meeting, Simons Foundation, NY	11/17
Paleobiology/Geobiology seminar series, Earth & Planetary Sciences, Harvard University	10/17
Seminar, Marine Science, University of North Carolina	9/17
Joint seminar, Biology & Earth and Atmospheric Sciences, Georgia Tech	9/17
'Biogeochemical Dating in Deep Time', UConn/MIT Workshop	5/17
Research Seminar, Santa Fe Institute	4/17
Department Lecture Series, Earth, Atmospheric and Planetary Sciences, MIT	3/17
EEB seminar, Dept of Ecology and Evolutionary Biology, Yale University	2/16
GeoSci Seminar, Dept of Geophysical Sciences, University of Chicago	2/16
IGB Seminar, Carl R. Woese Institute for Genomic Biology, University of Illinois at Urbana-Champaign	2/16
Research Seminar, Dept of Geology and Geophysics, Yale University	1/16
Sack Lunch seminar, Program for Atmospheres, Oceans and Climate, MIT	9/14
Environmental Science and Engineering Seminar, Linde Center for Global Environmental Science, Caltech	4/14
'Quantitative Laws of Genome Evolution' workshop, Lake Como School for Advanced Studies	7/13
Origins of Life workshop, Earth-Life-Science-Initiative, Tokyo Tech University	6/13
'Engines of Life: Thermodynamic Pathways to Metabolism', NASA/ASU Beyond Center workshop	5/13
Research seminar, Institute for Marine and Coastal Sciences, Rutgers University	4/13
'Catalytic Mechanisms and the Emergence of Biochemical Networks' (co-organizer), SFI/NSF workshop	5/12
Bauer Forum, Bauer Center for Systems Biology, Harvard University	10/11
Research seminar, Geophysical Laboratory, Carnegie Institute of Washington	6/11
Research seminar, Center for Biodynamics, Boston University	3/10
Research seminar, Santa Fe Institute	2/10

Recent conference Presentations:

- R. Braakman, K. Longnecker, J.W. Becker, K. Dooley, M.C. Kido Soule, E.B. Kujawinski, S.W. Chisholm, "Evolutionary metabolomics suggests *Prochlorococcus* drives an oceanic nucleotide economy", IMBIZO 5: Marine biosphere research for a sustainable ocean: Linking ecosystems, future states and resource management, October 2017 (poster)
- R. Braakman, M.J. Follows, S.W. Chisholm, "Evolutionary self-organization of oceanic microbial ecosystems and Neoproterozoic ocean oxygenation", 1st Geobiology Society Conference, June 2017 (poster)
- R. Braakman, M.J. Follows, S.W. Chisholm, "Metabolic evolution and the self-organization of ecosystems", 2016 Annual Life Science Research Foundation meeting, October 2016 (talk)
- R. Braakman, M.J. Follows, S.W. Chisholm, "Metabolic evolution and the organization of ecosystems: insights from the microbial oceans", Gordon Research Conference on Unifying Ecology Across Scales, July 2016 (poster)
- R. Braakman, M.J. Follows, S.W. Chisholm, "Metabolic evolution and the organization of ecosystems: insights from the microbial oceans", Gordon Research Conference on Marine Microbes, June 2016 (poster)
- R. Braakman, M.J. Follows, S.W. Chisholm, "Evolution of electron flows and the organization of ecosystems", Boston Bacterial Meeting, June 2016 (poster)
- R. Braakman, M.J. Follows, S.W. Chisholm, "Evolution of electron flows and the organization of ecosystems", Northeastern Geobiology Symposium, April 2016 (poster)

- R. Braakman, M.J. Follows, S.W. Chisholm, "Evolution of electron flows and the emergence of ecosystems", Gordon Research Conference on Geobiology, January 2016 (poster)
- R. Braakman, M.J. Follows, S.W. Chisholm, "Evolution of electron flows and the emergence of ecosystems", Populations, Evolution, and Physics Conference, Aspen Center for Physics, January 2016 (poster)
- R. Braakman, M.J. Follows, S.W. Chisholm, "Evolution of electron flows and the emergence of ecosystems", Re-conceptualizing the Origin of Life Conference, Carnegie Institute of Washington, November 2015 (poster)
- R. Braakman, M.J. Follows, S.W. Chisholm, "Evolution of electron flows and the emergence of ecosystems", 2015 Annual Life Science Research Foundation meeting, October 2015 (poster)
- R. Braakman, M.J. Follows, S.W. Chisholm, "Metabolic evolution of *Prochlorococcus*", 2014 Annual Life Science Research Foundation meeting, October 2014 (poster)
- R. Braakman, M.J. Follows, S.W. Chisholm, "Metabolic evolution of *Prochlorococcus*", Gordon Research Conference on Marine Microbes, June 2014 (poster)
- R. Braakman, "A metabolic tree of life: the emergence and early evolution of biological carbon-fixation", Astrobiology Graduate Conference, August 2012 (talk)
- R. Braakman, G.A. Blake, "Principles and promise of Fabry-Perot resonators at THz frequencies", International Astronomical Union symposium 280: 'The molecular Universe', June 2011 (poster)

Other Workshops/Working Groups Attended:

- "Minimal Life", NSF/SFI workshop, NSF headquarters, Arlington, VA 8/09
- "From Geochemistry to the Genetic Code", NSF/SFI working group, Santa Fe, NM 7/09
- "Compartmentation, Phase Separation and the Origin of Life", NSF/SFI workshop, Santa Fe, NM 6/08

Outreach and Teaching:

- Massachusetts Institute of Technology*
 Guest Lecturer, 12.090/12.S492: the Phylogenomic Planetary Record 2017
- Santa Fe Institute*
 Science consultant on origins of life exhibit at NM Museum of Natural History, Albuquerque 2011 – 2013
 Lecturer at SFI Complex Systems Summer School 2012
 Lecturer and panelist at NSF-sponsored origins of life workshop for high school teachers, Washington, DC 2011
- California Institute of Technology*
 Summer research mentor: Oversaw the summer research of 3 undergraduate students 2005 – 2007
 Teaching Assistant, Ch 21 b: Physical Chemistry: Atomic and Molecular Spectra 2005 – 2006
 Teaching Assistant, Ch 6 a,b: Physical Chemistry lab 2004
 Teaching Assistant, Ch 21 a: Physical Chemistry: Quantum Mechanics 2003

Service:

- Manuscript peer review*
 PLOS Computational Biology, Chemical Society Reviews, Proceedings of the National Academy of Sciences, Life, Frontiers in Microbiology, ISME Journal, Proceedings of the Royal Society B: Biological Science, Nature Microbiology, Philosophical Transaction of the Royal Society B: Biological Sciences
- Grant peer review*
 NSF Biological Oceanography, NASA Exobiology & Evolutionary Biology (panel reviewer)
- Santa Fe Institute*
 Chair, Colloquium committee 2010 – 2013
 Member, Omidyar Fellows selection committee 2010 – 2012
- California Institute of Technology*
 Panel member, International Student Orientation panel on integration and cultural adjustment 2004 – 2006
 Member, Foreign Students and Scholars Committee 2005 – 2007
- University of Amsterdam*
 Vice-President, University Student Council 1999 – 2000
 Member, Faculty Student Council, Faculty of Science and Mathematics 1999 – 2001
 Coordinator, general student council elections 2002