

BETUL KACAR

Harvard University

Organismic and Evolutionary Biology

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ACADEMIC APPOINTMENTS

HARVARD UNIVERSITY (Cambridge, MA)

2014-2017 Project Leader (Research Associate)

Organismic and Evolutionary Biology

ELSI- TOKYO INSTITUTE OF TECHNOLOGY (Tokyo, Japan)

2016-present Associate Professor

Origins of Life

NASA ASTROBIOLOGY INSTITUTE

2011-2014 Postdoctoral Fellow

Georgia Institute of Technology

Uppsala University

GEORGIA INSTITUTE OF TECHNOLOGY (Atlanta, GA)

2010-2011 Postdoctoral Fellow

School of Biology

EDUCATION

EMORY UNIVERSITY (Atlanta, GA)

2004-2010, Ph.D.

Biomolecular Chemistry | Biochemistry

MARMARA UNIVERSITY (Istanbul, Turkey)

2000-2004, B.S., Chemistry

FELLOWSHIPS AND AWARDS

NASA Exobiology Early Career Scientist Award (2017)

Way Cool Scientist, Science Club for Girls (2016)

VWR Scientific Excellence Award (2015)

NASA Postdoctoral Fellowship (2012-15)

NASA Astrobiology Institute, Early Career Research Collaboration Award (2011)

NASA Astrobiology Institute, Travel Scholarship (2010)

HHMI Curriculum Development Fellowship (2008)

NSF K12 Graduate Teaching Award (PRISM) (2006-07)

HHMI Summer Undergraduate Research Fellowship (2003)

GRANTS

NSF Origins of Life Research Grant (PI) (2017-20) (Main: CU Boulder) (Total: 2.25M)

Harvard Origins Initiative Seed Grant (PI) (2017) (15K)

NASA Origins of Life Research Grant (PI) (2017-19) (Main: UMN) (Total: 1.2M)

John Templeton Foundation, Big Questions in Life Sciences (PI) (2015-18) (805K)

ELSI Origins Network Seed Grant (PI) (2016) (10K)

NASA Exobiology and Evolutionary Biology Grant (Science PI) (2013-16) (380K)

NASA Astrobiology Institute Research Aid Grant (PI) (2013-2014) (10K)

PROFESSIONAL SERVICE

Member, Harvard Origins Initiative (2016-present)
Co-Investigator, NASA Astrobiology Institute Reliving the Past Node (2016-present)
Global Science Coordinator, ELSI Origins Network (2015-present)
NASA Postdoctoral Program, Grant Reviewer (2015-present)
Member, Blue Marble Space Institute of Science (2011-present)

NAMED LECTURES

SACNAS Faculty Diversity and Excellence Lecture, Harvard University (2017)
EAPS Lecture Series, Massachusetts Institute of Technology (2015)
VWR Scientific Excellence Award Lecture, Georgia Institute of Technology (2015)
Science, Progress and History Symposium Lecture, Oxford University (2014)

SELECTED PANELS, OUTREACH AND WORKSHOPS

Plenary Speaker, AbSciCon, Origins of Life, Arizona State University (2017)
Co-Organizer, Proto-Computation Proto-Life Workshop, Harvard University (2016)
Invited Participant, NASA Agnostic Life Workshop (2016)
Participant, NSF/NASA Origins of Life Ideas Lab (2016)
Interview, Cambridge Science Festival Documentary, Science Club for Girls (2016)
Invited Participant, NASA NEXSS Exoplanet Biosignatures Workshop (2016)
Speaker, NOVA Boston Science Café (Public Lecture) (2015)
Speaker, Re-conceptualizing the Origins of Life, Carnegie Institute (2015)
Participant, Experimental Evolution, NESCent Working Group (2015)
Speaker, Coretta Scott King Young Women's Leadership Academy, Atlanta (2014)
Co-Organizer, 1st ASM Conference on Experimental Microbial Evolution (2014)
Speaker, World Summit on Evolution, Galapagos Islands, Ecuador (2014)
Organizer, 1st Gordon Research Symposium, Microbial Population Biology (2013)
Participant, Astrobiology, Synthetic Biology, Evolution, NESCent Workshop (2011)
Founder, NASA Origins of Life Focus Group For Young Investigators (2011)
Co-Founder, SAGANet Astrobiology Mentorship and Outreach Network (2011)
Organizer, NASA Workshop Without Walls: Rewinding the Tape of Life (2010)

ADVISORY BOARDS

Bio-builder Evolution Division, Massachusetts Institute of Technology (2016-present)
SAGAN Astrobiology Outreach and Education Website (2015-present)

PUBLICATIONS

ARTICLES

1. **B. Kacar**, Guy L., Smith E., Baross J. "Paleophenotype reconstruction of carbon fixation proteins as a window into historic biological states" Proc Roy Soc B (in revision)
2. **B. Kacar**, Hanson-Smith V., Adam Z.R., Boekelheide N. "Reconstruction and Dynamic Modeling of Ancestral Rubisco Proteins" Geobiology (in revision)
3. **B. Kacar**, Garmendia E., Tuncbag N., Andersson D.I., Hughes D. "Replacement of an essential gene with its ancient and modern homologs" mBio (under review)

4. **B. Kacar**, Ge X., Sanyal S., Gaucher E.A. 2017. “Experimental evolution of *Escherichia coli* harboring an ancient translation protein” *J Mol Evol*, 84(2),69-84
5. **B. Kacar** and Gaucher E.A. 2013. “Experimental evolution of protein-protein interaction networks” *Biochem J*, 453(3), 311-319
6. **B. Kacar** and Gaucher E.A. 2012, “Towards the recapitulation of ancient history in the laboratory: Combining synthetic biology with experimental evolution” *Artificial Life*, 13, 11-18
7. **B. Kacar**, Boyd ES, Dolci W, Dodson E, Boldt M, Pilcher CB. 2011. *PLoS Biology*, 9(8):e1001118 Workshop without walls: Broadening science access around the world
8. Aldeco M, **B. Kacar**, Edmondson D.E. 2011. “Catalytic and Inhibitor Binding Properties of Zebrafish Monoamine Oxidase (zMAO): Comparisons with human MAO A and MAO B” *Comp. Biochemistry*, 159(2):78-83
9. **B. Kacar** and Edmondson D.E. 2010. “Expression of Zebrafish (*Danio rerio*) Monoamine Oxidase (MAO) in *Pichia pastoris*: Purification and Comparison with Human MAO A and MAO B” *Protein. Exp. Purif.*, 70(2):290-297

BOOK CHAPTERS AND PRIMERS

10. **B. Kacar**, 2016. “Rolling the dice twice: Evolving reconstructed ancient proteins in extant organisms” in *Chance in Evolution* pp 265-276, C. Pence and G. Ramsay, eds, University of Chicago Press
11. **B. Kacar**, 2016. What is LUCA? in *Astrobiology Primer 2.0* S. Domagal-Goldman and K Wright K, eds, *Astrobiology* 16(8):561-653
12. **B. Kacar**, Horak R. 2016. “What does the tree of life tell us about how life has evolved?” in *Astrobiology Primer 2.0* S. Domagal-Goldman and K Wright K, eds, *Astrobiology* 16(8):561-653

SELECTED RESEARCH FEATURES/POPULAR PRESS

- “Reconstructing Evolution: A Molecular Time Machine”, NASA Astrobiology Institute, 2016.
- “Why are scientists trying to reconstruct ancient genes?”, WGBH Boston, February 2016.
- “Biologists Invoke the Past in Modern Bacteria” by Emily Singer, *Quanta Magazine*, 2015.
- “Cells, Planets” SETI Wow! Signal Podcast, Season 2, Episode 4, August 2014.
- “Into The Origins” PBS NASA Origins of Life Documentary, January 2014.
- “Giving Ancient Life Another Chance to Evolve” *Astrobiology Magazine*, December 2013
- “Biologists Replay Million Years Evolution In The Lab” *MIT Tech Review*, September 2013.
- “Splicing a 500-Million-Year-Old Gene Into Modern Bacteria” *Popular Science*, April 2013.
- “Ancient DNA brought back to life”, *BBC Focus*, September 2012.
- “Ancient Gene Inserted in *E. coli*” *Wired*, July 2012.

INVITED SYMPOSIA / WORKSHOP PRESENTATIONS

- 2018 6th Annual ELSI Conference, Tokyo, Japan (January) (upcoming)
- 2017 Astrobiology Science Conference, Phoenix, AZ (April)
- University of Connecticut, Biogeochemical Dating in Deep Time (May) (upcoming)
- 1st International Geobiology Conference, Banff, Canada (June) (upcoming)
- 2016 NASA Astrobiology Institute Executive Council Meeting, Missoula, MT (July)
- Michigan State University BEACON Center Annual Workshop, MI (August)
- 2015 Astrobiology Science Conference, Chicago, IL (June)
- 2014 Gordon Research Conference, Origins of Life, Galveston, TX (January)
- 1st ASM Meeting on Microbial Experimental Evolution (June)

- 2013 Gordon Research Conference, Microbial Population Biology, Andover, MA (July)
- 2012 International Conference on the Synthesis and Simulation of Living Systems, MI (June)
- 2011 NASA Workshop Without Walls: Rewinding The Tape of Life (April)
- 2009 International Amine Oxidases and Related Diseases Conference, Beijing China (June)
- 2008 Excellence in Education Conference, University of Colima, Colima, Mexico (January)

INVITED UNIVERSITY / INSTITUTE SEMINARS (not including Named Lectures)

- 2017 University of Arizona, Tucson, AZ (February)
University of Illinois, Urbana-Champaign (September) (upcoming)
- 2016 Dalhousie University, Department of Biochemistry and Molecular Biology (March)
McGill Space Institute, Montreal, Canada (April)
Harvard University, Origins Initiative (Chalk Talk) (May)
Brcko US State Department Community Center, Bosnia (Public Talk) (August)
Harvard University, Natural Intelligence Group (December)
- 2015 ELSI Earth-Life Science Institute, Tokyo, Japan (May)
University of New Hampshire, Durham NH (March)
Uppsala University, Department of Microbiology, Uppsala, Sweden (September)
- 2014 Oberlin College, Department of Biology, Oberlin, OH (March)
- 2013 Carnegie Institute of Washington, Bethesda, MD (February)
BEYOND Center, Arizona State University, Phoenix, AZ (May)
ELSI Earth-Life Science Institute, Tokyo, Japan (September)
NASA Jet Propulsion Laboratory, Pasadena, CA (November)
- 2011 The Smithsonian Institution, Human Origins (February)
- 2009 Emory University, Graduate Research Interdisciplinary Team of Scholars (December)
North Georgia College and State University (March)

TEACHING ACTIVITIES

HARVARD UNIVERSITY

Graduate Advising and Current Position

- Andres Ferrino Iriarte (MEME Scholar) (still in my group)
- Gokce Senger (Bioinformatics) (still in my group)
- Ulku Uzun (MEME Scholar) (Graduate Student at Oxford University)

Other Advising (Interim Advisor, Project Director or Exam Committee)

- Sophie Wendell (DTU Novo Nordisk, Denmark)
- Eva Garmendia (Uppsala University, Sweden)
- Tracy Washington (Postdoc, Harvard University) (Current: Tufts Medical School)
- Brett Enos (Lab Tech, Harvard University)

Undergraduate Advising

- Hanon McShea (Harvard OEB). Senior Thesis: TBD. 2016-2017.
- Ryan Ward (Harvard Chemistry). Senior Thesis: TBD. 2016-2017.
- Stuart Brown (Synthetic Biology). Visiting, 02-08/2017.
- Divjot Kaur (Synthetic Biology), Visiting, 02-08-2017.
- Anna Donovan (Harvard MSI Fellow). Senior Thesis: TBD. 2016-2017.
- Cierra Armstrong (Microbiology), 11/2016-present.
- Alex Plesa (Harvard MSI Fellow). Summer Student. 2016.

GEORGIA INSTITUTE OF TECHNOLOGY

Astrobiology (Spring 2014), Evolution (Fall 2013), Prokaryotic Molecular Genetics (Guest Lecture, Lead: Brian Hammer, Fall 2012).

Undergraduate Advising and Current Position

Peter Schnaak, 2013-2014 (Medical Student at U Penn)

Lily Tran, 2011-2014. (Research Technician at Georgia Tech)

Jennifer Zhang, 2013-2014 (Scientist, Center for Disease Control and Prevention)

PEER REVIEW

Journals: Journal of Molecular Evolution, Molecular Biology and Evolution, Astrobiology, Nature, BMC Evolutionary Biology, BMC Biology, PLoS ONE, Proc Roy Soc Phil Trans B, Ad hoc reviewer: National Science Foundation *Environmental Biology* (2016), *Genetic Mechanisms* (2016, 2017), *Geobiology & Low Temp Geochem* (2017). NASA: *NASA Postdoctoral Program (Astrobiology and Space Biology)*.

PROFESSIONAL AFFILIATIONS

American Society for Microbiology (ASM)

NASA Astrobiology Institute (NAI)