BETUL KACAR

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Molecular and Cell Biology
Astronomy
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ACADEMIC APPOINTMENTS

UNIVERSITY OF ARIZONA (Tucson, AZ)
- 2017-present Assistant Professor
- Molecular and Cell Biology
- Astronomy

TOKYO INSTITUTE OF TECHNOLOGY (Tokyo, Japan)
- 2016-present Associate Professor
- ELSI Earth-Life Science Institute

HARVARD UNIVERSITY (Cambridge, MA)
- 2014-2017 Project Leader (Research Associate)
- Organismic and Evolutionary Biology, *Faculty Mentor: Scott Edwards*

NASA ASTROBIOLOGY INSTITUTE
- 2011-2014 Astrobiology Postdoctoral Fellow
- Uppsala University, *Host: Dan Andersson*
- Georgia Institute of Technology, *Host: Eric Gaucher*
- Michigan State University, *Host: Richard Lenski*

EDUCATION

EMORY UNIVERSITY (Atlanta, GA)
- 2004-2010, Ph.D.
- Biomolecular Chemistry | Biochemistry

MARMARA UNIVERSITY (Istanbul, Turkey)
- 2000-2004, B.Sc., Chemistry

FELLOWSHIPS AND AWARDS

- NASA Early Career Fellow (2018)
- 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, Scholarship (2010)
- HHMI Curriculum Development Fellowship (2008)
- NSF K12 Graduate Teaching Award (PRISM) (2006-07)
- HHMI Summer Undergraduate Research Fellowship (2003)

GRANTS

- John Templeton Foundation, Big Questions in Life Sciences (PI) (2018-19) (380K)
- NSF Collaborative Research Grant EF (PI) (2017-20) (405K) (Total: 2.2M)
- NASA Origins of Life Collaborative Grant (PI) (2018-20) (150K) (Total: 1.2M)

Harvard Origins Initiative Seed Grant (PI) (2017) (10K)
NASA Astrobiology Institute Reliving the Past Node CAN7 (Co-I) (2016-present)
John Templeton Foundation, Big Questions in Life Sciences (PI) (2015-17) (405K)
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

Associate Editor, Journal of Molecular Evolution (2018-present)
Steering Committee, NSF RCN Origins of Life (Lead: Santa Fe) (2018-2021)
Member, Harvard Origins Initiative (2016-present)
Global Science Coordinator, ELSI Origins Network (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 AND WORKSHOPS

Moderator, Exobiology Plenary Session, ASM Microbe General Meeting (2018)
Speaker, Future of Life, Library of Congress, Washington DC (2017)
Plenary Speaker, AbSciCon, Origins of Life, Arizona State University (2017)
Invited Participant, NASA Agnostic Life Workshop (2016)
Invited Participant, NSF/NASA Origins of Life Ideas Lab (2016)
Invited Participant, NASA NEXSS Exoplanet Biosignatures Workshop (2016)
Speaker, Re-conceptualizing the Origins of Life, Carnegie Institute Washington (2015)
Participant, Experimental Evolution, NESCent Working Group Durham, NC (2015)
Speaker, World Summit on Evolution, Galapagos Islands, Ecuador (2014)
Participant, Astrobiology, Synthetic Biology, Evolution, NESCent Workshop (2011)

ADVISORY BOARDS

Bio-builder Evolution, Massachusetts Institute of Technology (2016-present)
SAGAN Astrobiology Outreach and Education Platform (2015-present)
Ecology and Evolution Network of Turkey (2015)

PUBLICATIONS (*correspondence)

FORTHCOMING

1. Adam ZR, Lynch K, Walther-Antonio M, Wilford K, Som SS and **B. Kacar** "Metazoan origins as microbial host volumes in Neoproterozoic oligotrophic seas"
2. Bains W, Cronin L, DasSarma S, Danielache S… **B. Kacar** & others. "Exoplanet Biosignatures: Future Directions" *(in press,* **Astrobiology***)*

ARTICLES

1. Adam ZR, Fahrenbach A, **B. Kacar**, Aono M. 2018 "Prebiotic geochemical automata at the intersection of radiolytic chemistry, physical complexity and systems biology" **Complexity** (18)e9376183
2. **B. Kacar***, Guy L, Smith E, Baross J. 2017 "Resurrecting ancient biosignatures in modern bacteria" **Phil Trans A** 375(2109)
3. **B. Kacar***, Hanson-Smith V, Adam ZR, Boekelheide N. 2017 "Reconstruction and dynamic modeling of ancestral Rubisco proteins" **Geobiology** 15(5):628-640
4. **B. Kacar***, Garmendia E, Tuncbag N, Andersson DI, Hughes D. 2017 "Replacement of an essential gene with its ancient and modern homologs" **mBio** 8(4)e01276-17
5. **B. Kacar***, Ge X., Sanyal S, Gaucher EA. 2017. "Experimental evolution of Escherichia coli harboring an ancient translation protein" **J Mol Evol**, 81:1-16
6. **B. Kacar*** and Gaucher EA. 2013. "Experimental evolution of protein-protein interaction networks" **Biochem J**, 453(3), 311-319
7. **B. Kacar*** and Gaucher EA. 2012, "Towards the recapitulation of ancient history in the laboratory" **Artificial Life**, 13, 11-18
8. **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
9. **B. Kacar+**, Aldeco M+, Edmondson DE. 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 (+equal contribution)
10. **B. Kacar** and Edmondson DE. 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

11. Domagal-Goldman S, Kiang NY, Parenteau N, Catling DC, DasSarma S… **B. Kacar** & others. 2017. "Life Beyond the Solar System: Remotely Detectable Biosignatures" *(**arXiv**:1801.06714, NASA white paper submitted to the National Academy of Sciences)*
12. **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
13. **B. Kacar**, 2016. What is LUCA? in Astrobiology Primer 2.0 S. Domagal-Goldman and Wright K, eds, **Astrobiology** 16(8):561-653
14. **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 Wright K, eds, **Astrobiology** 16(8):561-653

SELECTED RESEARCH FEATURES/POPULAR PRESS

"What Happens When You Put Evolution on Replay?" Space.com, 2018.
"Resurrected Gene Allows Travel to an Earth Before Oxygen", New Scientist, 2017.
"This Enzyme Enabled Life to Conquer a Hostile Earth", Astrobiology, 2017.
"Reconstructing Evolution: A Molecular Time Machine", NASA, 2016.
"Biologists Invoke the Past in Modern Bacteria" Quanta Magazine, 2015.
"Cells, Planets" SETI Wow! Signal Podcast, Season 2, Episode 4, 2014.
"Into the Origins" PBS NASA Origins of Life Documentary, 2014.
"Giving Ancient Life Another Chance to Evolve" Astrobiology Magazine, 2013.
"Biologists Replay Million Years Evolution in The Lab" MIT Tech Review, 2013.

"Splicing a 500-Million-Year-Old Gene into Modern Bacteria" Popular Science, 2013.
"Ancient DNA Brought Back to Life', BBC Focus, 2012.
"Ancient Gene Inserted in E. coli" Wired, 2012.

INVITED SYMPOSIA / WORKSHOP PRESENTATIONS

2018 ASM General Meeting, Plenary Lecture, Atlanta, GA (Upcoming)
2017 Astrobiology Science Conference, Phoenix, AZ (April)
University of Connecticut, Biogeochemical Dating in Deep Time (May)
1st International Geobiology Conference, Banff, Canada (June)
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)

SELECTED INVITED UNIVERSITY LECTURES (not including Named Lectures)

2018 Duke University, Molecular and Cell Biology (February)
University of Illinois, Urbana-Champaign (April)
2017 Princeton University, EGGS Seminar Series (November)
University of Washington, Astrobiology Colloquium (December)
2016 Dalhousie University, Department of Biochemistry and Molecular Biology (March)
McGill Space Institute, Montreal, Canada (April)
Harvard University, Origins Initiative (Chalk Talk) (May)
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)

SELECTED OUTREACH TALKS (2015-present)

Flandrau Planetarium, Exoplanets and Astrobiology, Tucson AZ (2018)
Origins of Life, NPR Arizona Science Now (2017)
US State Department Community Center, Brcko, Bosnia (Public Talk) (2016)
Why Are Scientists Trying to Reconstruct Ancient Genes?, WGBH Boston, (2016)
Speaker, Cambridge Science Festival Documentary, Science Club for Girls (2016)
Speaker, NOVA Boston Science Café (Public Lecture) (2015)

COMMUNITY SERVICE

Organizer, ASM Microbe General Meeting, Exobiology Plenary Session (2018)
Co-Organizer, Universal Biology Workshop, Tokyo Institute of Technology (2017)
Co-Organizer, Proto-Computation Proto-Life Workshop, Harvard University (2016)
Co-Organizer, 2nd ASM Conference on Experimental Microbial Evolution (2016)
Organizer, 1st Gordon Research Symposium, Microbial Population Biology (2013)
Co-Organizer, 1st ASM Conference on Experimental Microbial Evolution (2014)
Founder, NASA Origins of Life Focus Group for Young Investigators (2011)
Founder, SAGANet Astrobiology Mentorship and Outreach Network (2011)
Organizer, NASA Workshop Without Walls: Rewinding the Tape of Life (2010)

TEACHING ACTIVITIES

UNIVERSITY OF ARIZONA
Guest Lecturer: Quantitative Biology Seminar (Spring 2018).

HARVARD UNIVERSITY
Chance in Evolution (Graduate seminar, co-lead. Lead: Jonathan Losos) (Spring 2016).

GEORGIA INSTITUTE OF TECHNOLOGY
Guest Lecturer: Astrobiology (Spring 2014), Evolution (Fall 2013), Prokaryotic Molecular Genetics (Fall 2012).

ADVISING

UNIVERSITY OF ARIZONA

Graduate Students
Pearl Lam (ABBS)

Postdoctoral Fellows
Amanda Garcia (PhD 2018 UCLA; Geobiology) Joining June 2018.
Sandeep Venkataram (PhD 2016 Stanford; Population Biology, co-advised with Sergey Kryazhimskiy UCSD) April 2018-present.

Research Technician
Madison Levinson

HARVARD UNIVERSITY

Undergraduate Advising (Current position)
Hanon McShea (OEB/EPS) Senior Thesis. 2016-17. *(NSF GRFP Fellow)*
Ryan Ward (CHEM) Senior Thesis. 2016-17. *(Fulbright Scholar,France)*
Anna Donovan (Colby College). 2016-17. *(MEME Evolutionary Biology Scholar)*
Alex Plesa (Colby College) 2016-17. *(Graduate student at Harvard Medical School)*
Jennifer Zhang (Georgia Tech) 2013-14. *(Research Specialist at CDC)*
Lily Tran (Georgia Tech) 2011-14. *(Research Technician at Georgia State U)*

Visiting Students
Gokce Senger (Turkey) Summer 2015. *(Graduate Student at METU).*
Ulku Uzun (MEME Scholar) Summer 2016. *(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)

PEER-REVIEW
Reviewer: Molecular Biology and Evolution, Journal of Molecular Evolution, Science, Astrobiology, Nature, BMC Evolutionary Biology, BMC Biology, PLoS ONE.

Panel chair: NASA Exobiology Program, *Panel Reviewer*: National Science Foundation CAREER (MCB/EEB)

Ad hoc reviewer: National Science Foundation *Environmental Biology* (2016), *MCB Genetic Mechanisms* (2016/17/18), *EEB (2017)*, *Geobiology & Low Temp Geochem* (2017). NASA: *NASA Postdoctoral Program (Astrobiology and Space Biology),* (2015/15/17/18).

PROFESSIONAL AFFILIATIONS
American Society for Microbiology (ASM)
NASA Astrobiology Institute (NAI)