

Princeton Center for Theoretical Science

The Princeton Center for Theoretical Science is dedicated to exploring the frontiers of theory in the natural sciences. Its purpose is to promote interaction among theorists and seed new directions in research, especially in areas cutting across traditional disciplinary boundaries.

The Center is located on the fourth floor of Jadwin Hall.



Origins of Life

January 21-24, 2013

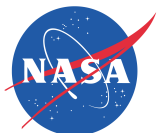
Jadwin Hall, Room 407, PCTS

Program Organizers

Laura Landweber (Ecology & Evolutionary Biology); Aaron Goldman (Ecology & Evolutionary Biology); Adam Burrows (Astrophysical Sciences & PCTS); Chris Chyba (Astrophysical Sciences and the Woodrow Wilson School); Ed Turner (Astrophysical Sciences); Jeremy Kasdin (MAE); Tullis Onstott (Geosciences); Michael Hecht (Chemistry)

**Jointly sponsored by the NASA Astrobiology Institute (NAI),
Society for Molecular Biology and Evolution (SMBE) and
Princeton Center for Theoretical Science (PCTS)**

To find out more about PCTS Postdoctoral Fellowships and Programs see:
<http://pcts.princeton.edu/pcts>



Origins of Life

Monday, 21 January 2013

8:00am *Breakfast (on site)*

8:55 am **Welcoming Remarks, Laura Landweber & Aaron Goldman**

Session Chair: **Adam Burrows**

9:00am “The limits of life on Earth”
John Baross, University of Washington

9:35am “Earth's early atmosphere and climate”
Jim Kasting, The Pennsylvania State University

10:10am *Coffee and Discussion*

10:40am Cosmochemistry and the origin of life
Sandra Pizzarello, Arizona State University

11:15am Chance and the origin of life
Dave Spiegel, Institute for Advanced Study

11:50am The algorithmic origins of life
Sara Walker, Arizona State University

12:25pm *Lunch (on site)*

Session Chair: **Aaron Goldman**

1:30pm Bringing rocks to life: Hydrothermal vents and microbial origins
Bill Martin, Heinrich-Heine-Universität

2:05pm Emergence of Bioenergetics in Hydrothermal Vents on the Early Earth
Laurie Barge, NASA Jet Propulsion Laboratory

2:40pm Reactivity of pyruvate under simulated hydrothermal vent conditions
Shelley Copley, University of Colorado Boulder

3:15pm *Coffee and Discussion*

3:45pm What do ancient proteins tell us about early life on Earth
Eric Gaucher, Georgia Institute of Technology

4:20pm Biology and the chemistry of the possible
Jim Cleaves, Carnegie Institution of Washington

Tuesday, 22 January 2013

8:00am *Breakfast (on site)*

Session Chair: **Laura Landweber**

9:00am Origins of life chemistry – reconciling the iron-sulfur and the RNA worlds
John Sutherland, MRC Laboratory of Molecular Biology

9:35am A semicontinuous process to form oligomeric RNA
Steven Benner, Foundation for Applied Molecular Evolution

10:10am *Coffee and Discussion*

10:40am The origin of the RNA world
Paul Higgs, McMaster University

11:15am A ribonucleotide origin – the sporadically fed pool
Michael Yarus, Colorado University

11:50am RNA fitness landscapes
Irene Chen, UC Santa Barbara

12:25pm *Lunch (on site)*

Session Chair: **Ed Turner**

1:30pm RNA synthesis inside protocell vesicles
Katarzyna Adamala, Harvard University

2:05pm Investigating the role of compartmentalization in the origin of life using microfluidics
Rebecca Turk MacLeod, École Supérieure de Physique et de Chimie Industrielles

2:40pm Active RNA droplets: Intracellular and protocellular assembly
Cliff Brangwyne, Princeton University

3:15pm *Coffee and Discussion*

3:45pm RNA evolution and my grandfather's axe
Nicholas Hud, Georgia Institute of Technology

4:20pm RNA-catalyzed RNA replication
Jamie Attwater, MRC Laboratory of Molecular Biology

Wednesday, 23 January 2013

8:00am *Breakfast (on site)*

Session Chair: **Cliff Brangwynne**

9:00am The relationship between early metabolism and prebiotic mineral catalysis

John Peters, Montana State University

9:35am Ironing out ancient biochemistry

Loren Williams, Georgia Institute of Technology

10:10am *Coffee and Discussion*

10:40am Spontaneous network formation among cooperative RNA replicators

Nilesh Vaidya, Princeton University

11:15am A Formal Framework for Autocatalytic Sets

Wim Hordkijk, SmartAnalytiX.com

11:50am Transport of DNA and RNA in temperature and solute gradients: A possible molecular sorter for early life

Yusuke Maeda, Kyoto University

12:25pm *Lunch (on site)*

Session Chair: **Christopher Chyba**

1:30pm Origins and evolution of the ribosome

George Fox, University of Houston

2:05pm The origin of protein structures and functions

Andrew Pohorille, NASA Ames Research Center

2:40pm Synthetic biology: Enabling life with molecular parts designed in the laboratory

Michael Hecht, Princeton University

3:15pm *Coffee and Discussion*

3:45pm Reconstructing the ancient proteome

Aaron Goldman, Princeton University

4:20pm Coalescence, gene transfer, and the study of pre-LUCA molecular evolution

Peter Gogarten, University of Connecticut

Thursday, 24 January 2013

8:00am *Breakfast (on site)*

Session Chair: **Tullis Onstott**

9:00am Comparative genomics and cell evolution: Not all RNA-related processes are ancient

Antonio Lazcano, Universidad Nacional Autónoma de México

9:35am Phylogeny of cell shape: A window into origins or adaptive dead end?

Janet Siefert, Rice University

10:10am *Coffee and Discussion*

10:40am Recombining horizontal gene transfers resolve conflicting narratives for the origin of eukaryotes

Greg Fournier, Massachusetts Institute of Technology

11:15am *Oxytricha* as a modern analog of ancient genome evolution

Laura Landweber, Princeton University

11:50am Hydrothermal polymerization: Nanopore analysis of RNA-like products

David Deamer, UC Santa Cruz

12:25pm **Concluding remarks**

12:35pm *Lunch (on site) and departures*