Shahar Bracha, PhD

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Research interests: I believe there is a huge untapped potential in bringing together ecology and evolutionary biology with synthetic biology and bioengineering. This includes (1) developing technologies and experimental approaches that help us learn about and harness the astonishingly vast diversity of molecular mechanisms in nature, to identify and engineer molecular tools to address big technological challenges in neuroscience, gene editing, human diseases and climate change mitigation; (2) applying principles and insights from evolution to develop better approaches for engineering biology (which is messy, chaotic and beautifully more complex than other systems for engineering). Primary, I am interested in evolutionarily-informed methods for protein engineering and machine learning-based modeling of sequence landscapes and sequence-to-function mapping; (3) using bioengineering to experimentally test hypotheses related to evolvability, speciation, adaptation, endosymbiosis, emergence of new traits and molecular mechanisms, and the theoretical limits of biological systems.

Education

Ph.D. **Neuroscience**	**Tel Aviv University** Direct Ph.D. program, Sagol School of Neuroscience. Thesis title: "*Engineering Toxoplasma gondii for delivery of therapeutic proteins to the central nervous system*". Supervisor: Prof. Oded Rechavi. Visiting researcher at the University of Glasgow, UK (joint mentorship by Dr. Lilach Sheiner)	2013 - 2020
B.Sc. **Biology**	**Tel Aviv University** *Magna Cum Laude*	2010 - 2013

Research Experience

Postdoctoral Associate, Massachusetts Institute of Technology (MIT) 2021-Present
Advisor: Prof. Ed Boyden

Co-inventor and Scientific Advisor, Epeius Pharma Ltd. 2019 - Present
Helped establish and act as a scientific advisor for the biotech startup, which is developing *T. gondii*-based vectors for protein therapy, based research and intellectual property generated in my PhD.

Publications, preprints and patents

- Shahar Bracha, Hannah J. Johnson, Nicole A. Pranckevicius, Francesca Catto, Athena E. Economides, Sergey Litvinov, Karoliina Hassi, Marco Tullio Rigoli, Cristina Cheroni, Matteo Bonfanti, Alessia Valenti, Sarah Stucchi, Shruti Attreya, Paul D. Ross, Daniel Walsh, Stuart Cobb, Petros Koumoutsakos, Nicolò Caporale, Giuseppe Testa, Adriano Aguzzi, Anita A. Koshy, Lilach Sheiner, Oded Rechavi. **Engineering a Brain Parasite for Intracellular Delivery of Proteins to the Central Nervous System**. *Under review.*
- Posner R, Toker IA, Antonova O, Star E, Anava S, Azmon E, Hendricks M, Bracha S, Gingold H, Rechavi O. **Neuronal Small RNAs Control Behavior Transgenerationally**. *Cell (2019).*
- Bracha S, Pranckevicius AN, Johnson HJ, Hassi K, Atterya S, Ross PD, Cobb S, Koshy AA, Sheiner L, Rechavi O. **Engineering a Brain Parasite for Intracellular Delivery of Therapeutic Proteins to the Central Nervous System**. *bioRxiv (2018).*
- Rechavi O, Bracha S, Sheiner S (2017). Engineered parasites for delivering protein to the central nervous system (cns). PCT/IL2017/050731 ; WO2018002938A1.

Conference abstracts

Oral presentations:

Yang-Tan Research Centers Retreat, MIT, MA, USA, June 3, 2022. ***"Engineering serendipity: the BioNet collaborative network for mining molecular tools from the natural world".***

Teva's national bioinnovators forum, February 23, 2021 (virtual). ***"Harnessing nature's solution for drug delivery to the brain".***

Annual meeting of the Israel Physical Society (IPS), February 17, 2020, Weizmann Institute, Israel. ***"Two Extreme Explosions of H-rich Stars".***

Charity Gala for Tel Aviv University, October 23, 2019, International Club Berlin, Germany. ***"Engineering a brain parasite to deliver therapies across the blood-brain-barrier".***

ToxoUK, November 1-2, 2018, Imperial College London, UK. ***"Using Toxoplasma gondii as a vector for therapeutic protein delivery to the CNS"***

Biology of Host-Parasite Interactions Gordon Research Conference and Gordon Research Seminar, June 9-15, 2018, Salve Regina University, RI, USA. ***"Using Toxoplasma gondii as a vector for therapeutic protein delivery to the CNS".***

Posters:

Protein Engineering Gordon Research Conference: Expanding the Boundaries of Protein Engineering, July 23-28, 2023, Bryant University, RI, USA. **"Experimental large scale phenotyping of proteins for machine learning-guided sequence-function modeling and design".**

Applied and Environmental Microbiology Gordon Research Conference: Writing the Microbial Constitution, July 16-21, 2023, Mount Holyoke College, MA, USA. **"BLAST-in-a-Tube: Implementing homology search with physics rather than *in silico* to capture homologs directly from environmental metagenomic extracts".**

International Toxoplasma Congress, Riverside, CA, USA. May 22-26, 2022. ***"Engineering Toxoplasma gondii as a tool for intracellular delivery of proteins to the central nervous system".***

The extragalactic explosive Universe: the new era of transient surveys and data-driven discovery, September 16-19, 2019, European Southern Observatory, Germany. ***"SN 2018hmx: An Extreme Type II SN with High Nickel Mass."***

Infectious Disease Research Initiative Scotland Meeting, March 6-7, 2019, University of Dundee, UK. ***"Can we make an enemy a friend? Engineering Toxoplasma gondii as a vector for delivering therapeutic proteins to the brain"***

8th ILANIT / FISEB, February 20-23, 2017, Eilat, Israel. ***"Engineering Parasites for the Delivery of Therapeutic Proteins to the CNS".***

SENS 6th conference for ageing and regenerative medicine, 3-7 September, 2013, Queens' College, Cambridge University, UK. ***"The role of Clara cell senescence in the pathogenic mechanism of COPD"***

Prizes and scholarships

Yang-Tan Center for Molecular Therapeutics funded project: *"Biomining - a collaborative network for mining and forging molecular tools from nature"*	2022
The Daniel Turnberg Research Exchange Fellowship	2019
The Prajs-Drimmer Ph.D. Scholarship	2018
ToxoUK Travel Fellowship	2018

The Joan and Jaime Constantiner Institute Travel Fellowship	2018
University of Glasgow KE Grant	2016
Sagol School of Neuroscience Travel Fellowship	2016
The Naomi Foundation Global Research & Training Fellowship	2014
Scholarship for SENS research internship, Weizmann Institute of Science	2013
Scholarship for Amos De-Shalit program, Weizmann Institute of Science	2012