Curriculum Vitae - Highlights (August 2025)

Professional Summary

Theoretical physicist turned experimental quantitative biologist with discoveries of fundamental biological principles. One of 25 Bauer Fellows at the FAS Center for Systems Biology at Harvard University. Pioneer of single-cell physiology with the invention of the microfluidic mother machine. Leads an interdisciplinary research program spanning bacteria, archaea, and eukaryotes, with a forward vision to integrate question-driven research with high-throughput single-cell experimentation, advanced robotics, modeling, and AI-driven discovery towards an autonomous lab. Recognized with major international awards and fellowships, including the Michael and Kate Bárány Award (2022) and the Simons Pivot Fellowship (2025).

Key Achievements

- Developed the entropy-driven chromosome segregation model in bacteria (2004–2012), a lasting conceptual advance.
- Invented the microfluidic "mother machine" (2010), pioneering single-cell physiology studies.
- Discovered the adder principle (2014) and elucidated its mechanistic basis (2019).
- Established a new framework of cellular resource allocation (2025).
- Expanded UCSD's biological physics program via strategic recruitment and community building (since 2020).
- Mentored multiple trainees to independent positions at Princeton, Carnegie Mellon, Westlake University.

Selected Honors & Awards

2013–2016 **Allen Distinguished Investigator Award**, the Paul G. Allen Family Foundation (cohort of 7 in the U.S.)
2013–2017 **Pew Scholars Award**, the Pew Charitable Trusts (cohort of 22 in the U.S.)
2013–2018 **CAREER Award**, National Science Foundation (NSF)
2022 **Michael and Kate Bárány Award**, Biophysical Society (list of awardees)
2025–2026 **Pivot Fellow,** The Simons Foundation (cohort of 8)

Selected Publications [total citations ~ 6100; average citations per paper ~160, H-index 32]

Single-cell physiology

1. **[Invention of the mother machine; ~1230 citations]**
   Wang *et al.*, Robust growth of *Escherichia coli*. **Curr Biol** 20, 1099–1103 (2010).
2. **[Cell-size control trilogy 1: reported the adder principle; ~830 citations]**
   Taheri-Araghi *et al.* Cell size control and homeostasis in bacteria. **Curr Biol** 25, 385-391 (2015).
3. **[Cell-size control trilogy 2: explanation of the origin of the cell-size law by Maaloe in 1958; ~250 citations]**
   Si *et al.* Invariance of the initiation mass and predictability of cell size in *Escherichia coli*. **Curr Biol** 27, 1278–1287 (2017).
4. **[Cell-size control trilogy 3: mechanistic explanation of the adder principle; ~280 citations]**
   Si *et al.* Mechanistic origin of cell-size control and homeostasis in bacteria. **Curr Biol** 28, 1760–1770 (2019).
5. **[Extensive review of the field surveying over 1000 papers; ~210 citations]**
   Jun *et al.,* Fundamental Principles in Bacterial Physiology - History, Recent progress, and the Future with Focus on Cell Size Control: A Review. **Reports on Progress in Physics**, 81 056601 (2018).

Precision control

6. **[Replication initiation as a general class of precision control based on protein counting; ~20 citations]**
   Fu *et al.*, Bacterial Replication Initiation as Precision Control by Protein Counting, **PRX Life** 1, 013011 (2023).
   Note: Physics Magatzine Viewpoint.

Cellular resource allocation

7. **[First phase diagram for Min proteins in vivo, integrating quantitative physiology and biophysics; 5 citations]**
   Ren *et al.* Robust and resource-optimal dynamic pattern formation of Min proteins in vivo to physiological perturbations. **Nature Physics** (2025).
8. **[Presents new paradigm of cellular resource allocation beyond E. coli that has dominated the field since 2010]**
   Thiermann *et al.* Decoupling of global metabolic flux and proteome in bacteria. **Revision under review** (2025).

Current Funding

4.2M USD total (Simons Foundation + NIH + DARPA).