

Justin S. Bois

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Education

Ph.D., Chemical Engineering, California Institute of Technology, 2007

B.S., Chemical Engineering, University of Illinois at Urbana-Champaign, 1999

Experience

- Jan. 2020 – Teaching Professor
Division of Biology and Biological Engineering, Caltech
- Jan. 2014 – Dec. 2019 Lecturer
Division of Biology and Biological Engineering, Caltech
- Jan. 2011 – Dec. 2013 Postdoctoral Researcher
Department of Chemistry and Biochemistry, UCLA
Research Group: Margot Quinlan
- Oct. 2007 – Dec. 2010 Visiting Scientist, Biological Physics Group
Max Planck Institute for Physics of Complex Systems and
Max Planck Institute of Molecular Cell Biology and Genetics, Dresden
Research Groups: Stephan Grill and Frank Jülicher
- May 2007 – July 2007 Postdoctoral Scholar
Department of Bioengineering, Caltech
Research Group: Niles Pierce
- Oct. 2001 – Apr. 2007 Graduate Student
Department of Chemical Engineering, Caltech
Research Groups: Niles Pierce and Zhen-Gang Wang
- Jan. 2000 – Apr. 2001 Research Engineer
Kraft Foods Technology Center, Glenview, Illinois

Teaching

As course instructor at Caltech

Data analysis in the biological sciences	2014–2025
Design principles of genetic circuits (with M. Elowitz)	2015–2025
Biophysical chemistry	2022–2025
Physical biology of the cell	2014, 2016, 2018, 2019, 2023, 2025
The great ideas of biology: Exploration through experimentation	2014–2025
Design and construction of biodevices	2017–2024
Introduction to programming in the biological sciences bootcamp	2015–2024
Data science for neuroscience	2025

Freshman Summer Research Institute programming bootcamp	2020
Signal transduction and mechanics in morphogenesis	2014–2021
Introduction to biomolecular engineering (with F. Arnold or N. Pierce)	2014, 2016, 2018, 2021
Order-of-magnitude biology (with R. Phillips)	2015, 2016

Extramural

Introduction to programming in the biological sciences bootcamp at EPFL	2018, 2019, 2022, 2023
Introduction to statistical inference in physical biology at Physics of Life Institute, Dresden	2022–2025
Frequent appearances on DataFramed podcast	2018–2019
Case Studies in Statistical Thinking (online course with DataCamp)	2017
Statistical Thinking in Python parts I and II (online courses with DataCamp)	2016
MBL Physiology Course Matlab Bootcamp (with H. Garcia and J. Boedicker)	2016
Guest instructor, Clubes de Ciencia, Ensenada, México	2014

Courses in previous positions

Physical principles for cell biologists (with N. Licata), MPI-CBG Dresden	2010
Introduction to biomolecular engineering (TA with N. Pierce), Caltech	2007
Graduate stat. mech. (TA with Z.-G. Wang and R. Marcus), Caltech	2003, 2005, 2006
Graduate thermodynamics (TA with C. Smolke), Caltech	2004
General chemistry (TA with D. DeCoste), U. of Illinois	1998, 1999

Software

Distribution Explorer: Instructional and reference app about probability distributions.

EQTK: Python package for solving coupled chemical equilibria.

iqplot: Python package for making Bokeh plots where one or more variable is categorical.

serial-dashboard: A browser (Bokeh)-based app for monitoring and plotting with serial devices.

biocircuits: Tools for analysis of biological circuits, complement to an upcoming digital book with M. Elowitz.

bebi103: Python package complementing my BE/Bi 103 ab data analysis courses.

dc-stat-think: Python package for resampling-based statistics.

rdsolver: Python package for solving reaction-diffusion equations in two dimensions.

NUPACK: Suite of analysis and design tools for nucleic acid systems (early developer).

Research Publications

A. L. Tribby, **J. S. Bois**, S. A. Montzka, E. L. Atlas, I. Vimont, X. Lan, P. P. Tans, J. W. Elkins, D. R. Blake, P. O. Wennberg (2022) Hydrocarbon tracers suggest methane emissions from fossil sources occur predominantly before gas processing and that petroleum plays are a significant source, *Environ. Sci. Technol.*, **56**, 9623–9631.

- C. J. Su, A. Murugan, J. M. Linton, A. Yeluri, **J. S. Bois**, H. Klumpe, Y. E. Antebi, M. B. Elowitz (2022) Ligand-receptor promiscuity enables cellular addressing, *Cell Syst.*, **13**, 408–425.
- P. Gross, K. V. Kumar, N. W. Goehring, **J. S. Bois**, C. Hoege, F. Jülicher, S. W. Grill (2019) Guiding self-organized pattern formation in cell polarity establishment, *Nature Physics*, **15**, 293–300.
- R. D. Nath, C. N. Bedbrook, M. J. Abrams, T. Basinger, **J. S. Bois**, D. A. Prober, P. W. Sternberg, V. Gradinaru, L. Goentoro (2017) The jellyfish *Cassiopea* exhibits a sleep-like state, *Curr. Biol.*, **27**, 2984–2990.
- B. Bor, N. Poweleit, **J. S. Bois**, L. Cen, J. K. Bedree, Z. H. Zhou, R. P. Gunsalus, R. Lux, J. S. McLean, X. He, W. Shi (2016) Phenotypic and physiological characterization of the epibiotic interaction between TM7x and its basibiont *Actinomyces*, *Microb. Ecol.*, **71**, 243–255.
- A. Webster, S. Li, J. K. Hur, M. Wachsmuth, **J. S. Bois**, E. M. Perkins, D. Patel, and A. A. Aravin (2015) Aub and Ago3 are recruited to nuage through two mechanisms to form a ping-pong complex assembled by Krimper, *Molecular Cell*, **59**, 564–575.
- B. Bor, **J. S. Bois**, M. E. Quinlan (2015) Regulation of the formin cappuccino is critical for polarity of *Drosophila* oocytes, *Cytoskeleton*, **72**, 1–15.
- A. S. Rasson, **J. S. Bois**, D. S. L. Pham, H. Yoo, M. E. Quinlan (2015) Filament assembly by Spire: Key residues and concerted actin binding, *J. Mol. Biol.*, **427**, 824–839.
- K. V. Kumar, **J. S. Bois**, F. Jülicher, S. W. Grill (2014) Pulsatory patterns in active fluids, *Phys. Rev. Lett.*, **112**, 208101.
- E. A. Roth-Johnson, C. L. Vizcarra, **J. S. Bois**, M. E. Quinlan (2014) Interaction between microtubules and the *Drosophila* formin Cappuccino and its effect on actin assembly, *J. Bio. Chem.*, **289**, 4395–4404.
- N. W. Goehring, P. Khuc Trong, **J. S. Bois**, D. Chowdhury, E. M. Nicola, A. A. Hyman, S. W. Grill (2011) Polarization of PAR proteins by advective triggering of a pattern-forming system, *Science*, **334**, 1137–1141.
- J. S. Bois**, F. Jülicher, S. W. Grill (2011) Pattern formation in active fluids, *Phys. Rev. Lett.*, **106**, 028103.
- J. N. Zadeh*, C. Steenberg*, **J. S. Bois***, B. R. Wolfe*, M. B. Pierce, A. R. Khan, R. M. Dirks, N. A. Pierce (2011) NUPACK: Analysis and design of nucleic acid systems, *J. Comput. Chem.*, **32**, 170–173.
- M. Mayer, M. Depken*, **J. S. Bois***, F. Jülicher, S. W. Grill (2010) Anisotropies in cortical tension reveal the physical basis of polarizing cortical flows, *Nature*, **467**, 617–621.
- A. V. Klopper, **J. S. Bois**, S. W. Grill (2009) Influence of secondary structure on the early stages of RNA transcription, *Phys. Rev. E*, **81**, 030904.
- L. Carvalho, J. Stühmer, **J. S. Bois**, Y. Kalaidzidis, V. Lecaudey, C.-P. Heisenberg (2009) Control of convergent yolk syncytial layer nuclear movement in zebrafish, *Development*, **136** (8), 1305–1315.
- R. M. Dirks*, **J. S. Bois***, J. M. Schaeffer, E. Winfree, N. A. Pierce (2007) Thermodynamic analysis of interacting nucleic acid strands, *SIAM Rev.*, **49**, 65–88.
- J. S. Bois***, S. Venkataraman*, H. M. T. Choi, A. J. Spakowitz, Z.-G. Wang, N. A. Pierce (2005) Topological constraints in nucleic acid hybridization kinetics, *Nucleic Acids Res.*, **33** (12), 4090–4095.

*Authors contributed equally.

Review Articles and Book Chapters

J. S. Bois, S. W. Grill (2013) Mechanochemical pattern formation in the polarization of the one-cell *C. elegans* embryo, in *Engineering of Chemical Complexity*, A. S. Mikhailov and G. Ertl, Eds., World Scientific.

J. Howard, S. W. Grill, **J. S. Bois** (2011) Turing's next steps: The mechanochemical basis of morphogenesis, *Nature Rev. Mol. Bio.*, **12**, 392–398.

Service

Caltech Bioengineering undergraduate option representative (responsible for overseeing undergraduate study)
Fall 2017 – present

Caltech Core Curriculum Committee, Summer 2022 – Summer 2025

Caltech Athletics and Physical Education Committee, Summer 2021 – Summer 2027

Faculty liaison, Caltech men's soccer team, 2023 – present

Faculty liaison, Caltech women's soccer team, 2019 – present

Served or serving on Ph.D. thesis committees of 26 students at Caltech

Honors and Awards

2023	Alice Huang Leadership Award, Division of Biology and Biological Engineering, Caltech
2022	Student Committee for Undergraduate Bio. and Bio. Eng. Advancement Teaching Award
2021	Associated Students of the California Institute of Technology Teaching Award
2019	Caltech Graduate Student Council Teaching and Mentoring Award for instruction
2015	Caltech Graduate Student Council Teaching and Mentoring Award for instruction
2014	Associated Students of the California Institute of Technology Teaching Award
2008 – 2011	Human Frontier Science Program Cross-Disciplinary Fellowship
2003	Caltech Graduate Student Council Teaching and Mentoring Award for teaching assistants
2001 – 2002	William H. Corcoran Memorial Fellowship, Caltech
1999	UIUC Department of Chemical Engineering: Highest Distinction
1999	UIUC List of Teachers Ranked as Excellent (both semesters)
1998	UIUC List of Teachers Ranked as Excellent (fall semester)