JONATHAN LIU

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RESEARCH INTERESTS

Quantitative biology, gene regulation, modeling, spatial transcriptomics, multimodal data analysis

EDUCATION

University of California, Berkeley   *Aug 2016 - Present*
PhD in Physics (*expected graduation Summer 2021*)

California Institute of Technology   *Sept 2011 - June 2015*
BS in Applied Physics with Honors

APPOINTMENTS

NDSEG Graduate Research Fellow - UC Berkeley   *Aug 2017 - Present*

Research Advisor: Hernan Garcia

- Investigated biophysical models of gene regulation through live imaging fluorescence microscopy of nascent RNA transcription in fly embryos, with 2 first-author publications in *eLife* and *PLoS Computational Biology*
- Used modern image analysis tools such as machine learning segmentation to convert microscopy data into large time series (several TB, hundreds of cells over minutes with time resolutions of seconds)
- Applied statistical inference techniques (e.g. Markov Chain Monte Carlo) in MATLAB with statistical physics models of gene regulation to interpret time series datasets
- Used synthetic biology tools such as CRISPR to create fluorescent reporters for microscopy

Visiting Researcher - Chan-Zuckerberg Biohub   *Jan 2021 - Present*

Research Advisor: Angela Pisco

- Conducted data analysis in Python to compare resolution of spatial transcriptomics with existing single-cell RNA-seq technologies, with 1 first-author publication in preparation
- Collaborated with wet-lab researchers and industrial partners for project design and management

Fulbright Visiting Student - Ludwig Maximilian University of Munich   *Sept 2015 - July 2016*

Research Advisor: Dieter Braun

- Studied biomolecule accumulation in heated microscale fluid systems as a plausible scenario for the origins of life, resulting in cover-featured publication in *Nature Chemistry*
- Designed a microfluidic chamber to produce accumulations of over 1000-fold, and recapitulated findings with theoretical fluid mechanics model and finite-element simulations in COMSOL

HONORS AND AWARDS

2017 DoD NDSEG Graduate Fellowship (1 of 195 fellows)
2015 U.S. Fulbright Student Fellowship (1 of ∼100 fellows)
2015 Caltech B.S with Honors

2014 DAAD RISE Research Internship
2013 Caltech SURF Fellowship
2012 Caltech SURF Fellowship

PUBLICATIONS

1. Pranathi Vemuri*, **Jonathan Liu***, et. al. "Comparison of MERFISH spatial transciptomics with scRNA-seq methodologies." In preparation. (*equal authorship)

2. Yang Joon Kim, Kaitlin Rhee, **Jonathan Liu**, Yang Joon Kim, Paul Jeammet, Stephen Small, Hernan Garcia. "Quantitative dissection of synthetic enhancers reveal distinct tuning knobs of developmental gene expression pattern by transcriptional repressor." In preparation.

3. **Jonathan Liu**, Donald Hansen, Elizabeth Eck, Yang Joon Kim, Meghan Turner, Simon Alamos, Hernan Garcia. "Real-time single-cell characterization of the eukaryotic transcription cycle reveals correlations between RNA initiation, elongation, and cleavage." *bioRxiv*, Mar 2020. Accepted at *PLoS Computational Biology*.

4. Elizabeth Eck*, **Jonathan Liu***, Maryam Kazemzadeh-Atoufi, Sydney Ghoreishi, Shelby Blythe, Hernan Garcia. "Quantitative dissection of transcription in development yields evidence for transcription factor-driven chromatin accessibility." *eLife*, Oct 2020. (*equal authorship)

5. Matthias Morasch, **Jonathan Liu**, *et al.* "Heated gas bubbles enrich, crystallize, dry, phosphorylate, and encapsulate prebiotic molecules." *Nature Chemistry*, Jul 2019 (cover article).

TALKS PRESENTED

Nov 2020	Contributed	UC Berkeley Physics Compass Lecture Series
Nov 2020	Contributed	Northwestern University: Quantitative Approaches in Biology
Feb 2020	Contributed	Winter q-bio Conference
Aug 2019	Contributed	DoD NDSEG Graduate Conference
May 2019	Invited	DoD STIx on the Hill: Science, Technology, and Innovation Exchange
Jan 2019	Contributed	Gordon Conference: Stochastic Physics in Biology
Dec 2018	Invited	DoD Science, Technology, and Innovation Exchange
Nov 2018	Contributed	UC Berkeley Physics Compass Lecture Series
Feb 2018	Contributed	Biophysical Society 62nd Annual Meeting
Aug 2017	Contributed	Canadian-American-Mexican Graduate Student Physics Conference
Mar 2016	Invited	German Fulbright Berlin Conference

TEACHING AND MENTORING

Graduate Student Mentor - UC Berkeley SURF Office   *May 2019 - Aug 2019*

Organized professional development workshops, reviewed and helped develop student oral and poster presentations, and mentored undergraduate researchers in summer research program

Teaching Assistant - Caltech Physical Biology Boot Camp   *Sept 2018*

Assisted with week-long physical biology course for incoming graduate students
Designed and ran experimental module on live imaging of transcription in fruit flies

Graduate Student Instructor - Physics for Engineers and Scientists (7B)   *Aug 2016 - May 2017*

Taught small sections for large undergraduate physics course
Prepared section materials, supervised lab projects, held office hours, and graded exams

Student Tutor - Caltech Undergraduate Dean's Office   *Sept 2012 - June 2015*

Tutored undergraduate students in STEM courses

Students mentored:

Scout Weber (undergraduate, 2020)
Donald Hansen (graduate, 2019)
Liya Oster (graduate, 2018)
Aaron Perez (undergraduate, 2018)

OUTREACH AND SERVICE

Co-director, Team Member - Beyond Academia   *Aug 2019 - present*

Team member of student organization that hosts an annual two-day conference for 300+ current PhDs and postdocs, featuring over 100 speakers

Successfully organized pivot to online platform in 2021 due to COVID-19 pandemic and achieved record interest, with 3000+ registered attendees across 6 continents

Managed yearly budget of ∼$60,000 and coordinated fundraising across several campus departments and organizations

Contacted and planned speaker lists for panel and workshop events

Member - Graduate Professional Development Advisory Committee   *Sep 2019 - Dec 2019*

Discussed and planned initiatives for improving graduate student professional development as part of Academic Senate subcommittee

Member - UC Berkeley Physics Faculty Search Committee   *Jan 2019 - Mar 2019*

Part of graduate student subcommittee interviewing and reviewing applications for new faculty tenure-track position

Organizer - Grounds for Science   *July 2018 - Present*

Organizer for local public science lecture series, run by and for graduate students

Reader - UC Berkeley SURF Office   *Mar 2018*

Reviewed applications for summer undergraduate research fellowship program

Organizer - Physics Graduate Student Seminar   *Jan 2017 - Aug 2018*

Started and helped run seminar series for graduate students in UC Berkeley Physics department

Member - Physics Graduate Admissions Committee   *Jan 2018 - Mar 2018*

Helped plan and organize admitted graduate student visit program

Member - Caltech Academics and Research Committee   *Sept 2013 - June 2015*

Member of undergraduate committee overseeing undergraduate curriculum and research issues
Chaired 2015 committee on updating Applied Physics department curriculum requirements

WRITING

1. "An interview with QB3 Professional in Residence Tracy Teal - harnessing community to support scientific research." *QB3-Berkeley.*
   https://qb3.berkeley.edu/news/an-interview-with-professional-in-residence-tracy-teal-harne
2. "The Ins and Outs of Informational Interviewing." *Berkeley Science Review.*
   https://berkeleysciencereview.com/2020/12/informational-interviewing/
3. "Using physics to search for meaning in the chaos of gene regulation." *QB3-Berkeley.*
   https://qb3.berkeley.edu/using-physics-to-search-for-meaning-in-the-chaos-of-gene-regulati
4. "Machine Learning: Chapter 3 (Particle Physics)." *Berkeley Science Review (Fall 2018).*
   http://www.berkeleysciencereview.com/article/machine-learning-chapter-3/

5. "Why (anti)hydrogen matters." *Berkeley Science Review (Spring 2017).*
   http://berkeleysciencereview.com/article/why-antihydrogen-matters/

MISCELLANEOUS

Programming languages:	Python, MATLAB, Java, Mathematica
Software:	GitHub, Jupyter, NumPy, SciPy, Pandas, Matplotlib, ggplot2, Adobe Illustrator
Hardware:	Microfluidics, fluorescence microscopy, optics, electronic circuitry
Molecular biology:	PCR, cloning, transgene design, CRISPR/Cas9, synthetic biology
Analytical skills:	Statistical inference, modeling, numerical simulations, image analysis
Mathematical knowledge:	Calculus, linear algebra, differential equations, probability, statistics
Languages:	English (native), Mandarin (proficient), German (proficient)