Jacob C. Kimmel

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EDUCATION

University of California, San Francisco — San Francisco, CA
Ph.D. - Dept. of Biochemistry & Biophysics; Fellowships: NSF, PhRMA, UCSF Discovery — *Sept. 2015 – Apr. 2018*

University of Central Florida — Orlando, FL
B.S. (Honors) - Biotechnology; GPA: 4.0/4.0 — *Aug. 2012 – Apr. 2015*

Marine Biological Laboratory — Woods Hole, MA
Computational Image Analysis in Cell and Developmental Biology — *Fall 2016*

EXPERIENCE

Calico Life Sciences — South San Francisco, CA
Data Scientist, Computing — *May 2018 - Present*

- Lead an investigation of cell type and tissue environment influences on aging using single cell genomics across three murine tissues
- Developed timelapse image analysis methods for oncology applications, enabling multi-cell tracking and feature quantification over many days
- Automated quantification of yeast cell aging using convolutional neural networks
- Built an automated targeting system for laser ablation microscopy with sub-millisecond timing
- Developed a cell type identification method for single cell RNA-seq data using deep neural networks

University of California, San Francisco — San Francisco, CA
PhD Candidate; Thesis: Inferring cell state from cell behavior; Advisor: Wallace Marshall — *Sept. 2015 - Apr. 2018*

- Developed the `Heteromotility` biological motion analysis package, including feature extraction, unsupervised clustering, and time-series analysis to quantify dynamic state transitions in cellular systems
- Quantified rates of muscle stem cell activation in single cells for the first time using `Heteromotility`
- Developed `Lanternfish` deep learning package to enable discrimination of cell states from cell motility measurements and prediction of cell motility behaviors
- Performed single-cell RNA-sequencing to identify heterogeneous muscle stem cell states during aging and myogenic activation
- Developed a single cell assay of muscle stem cell age using single cell RNA-seq and machine learning

IBM Research — San Jose, CA
Deep Learning Intern, Cellular Engineering — *Sept. 2017 - Dec. 2018*

- Developed rapid convolutional neural network (CNN) based image segmentation methods for processing of high-throughput timelapse imaging data
- Implemented a Natural Evolution Strategies (NES) optimization framework to improve multi-cell tracking
- Implemented a software interface to custom microscopy hardware, allowing for automation of high-throughput timelapse imaging experiments

University of Central Florida — Orlando, FL
Research and Mentoring Program Scholar; Principal Investigator: Kiminobu Sugaya — *Aug. 2012 - Apr. 2015*

- Characterized induced pluripotent reprogramming from mesenchymal cells using image classification models
- Applied polarized optical torques to guide cell motility in primary neuronal cell populations
- Investigated direct reprogramming mesenchymal cells to neuronal fates by modulation of Nanog

University of California, San Francisco — San Francisco, CA
Amgen Scholar; Principal Investigator: K. Mark Ansel — *May. 2014 - Aug. 2014*

- Investigated the role of microRNA-29 in the regulation of cytokine production in T-cells

National Institute on Aging — Baltimore, MD
Summer Fellow, Image Informatics and Computational Biology Unit — *May 2012 - Aug. 2012*

- Identified differential aging rates across the anatomy of C. elegans using image classification models
- Investigated the relationship between cognitive and age related morphologies in the primate hippocampus

Skills

- **Data Analysis**: Experimental design, linear modeling, time series analysis, multivariate statistics
- **Machine Learning**: Supervised discrimination, unsupervised clustering, feature engineering
- **Deep Learning**: Deep convolutional and recurrent neural networks, PyTorch, Tensorflow
- **Image Analysis**: Image segmentation, classification, particle tracking
- **NGS**: Single cell and bulk RNA-seq analysis, samtools, IGV
- **Programming**: Python (scipy, scikit-learn, statsmodels), R, Matlab, git, bash, LaTeX
- **Experimental Biology**: Microscopy, single cell RNA-seq, primary cell culture, FACS, molecular biology

Selected Publications

1. **Kimmel JC**, Penland L, Rubinstein ND, Hendrickson DH, Kelley DR, Rosenthal AZ. A murine aging cell atlas reveals cell identity and tissue-specific trajectories of aging. 2019. bioRxiv. doi: 10.1101/657726.
2. **Kimmel JC**, Brack AS, Marshall WF. Deep convolutional and recurrent neural networks for cell motility discrimination and prediction. 2019. In press, *IEEE Transactions on Computational Biology and Bioinformatics*, doi: 10.1109/TCBB.2019.2919307. Preprint featured in *Company of Biologists: the Node*.
3. **Kimmel JC**, Chang AY, Brack AS, Marshall WF. Inferring cell state by quantitative motility analysis reveals a dynamic state system and broken detailed balance. 2018. *PLoS Computational Biology* 14(1): e1005927. doi: 10.1371/journal.pcbi.1005927. Featured in *PLoS Editor's Collections*.
4. Constant C, **Kimmel JC**, Sugaya K, Dogariu A. Optically controlled subcellular diffusion. 2015. *Frontiers in Optics & Laser Science*. doi: 10.1364/FIO.2015.FW5E.7.

Selected Presentations

1. **Kimmel JC**, Hwang A, Brack AS, Marshall WF. Inferring cell state dynamics with machine learning models. Invited oral presentation to the *Machine Learning in Cell Biology* session at ASCB-EMBO 2018. San Diego, CA. 2018.
2. **Kimmel JC**, Chang AY, Brack AS, Marshall WF. Inferring stem cell states from cell motility behavior reveals a dynamic state system and broken detailed balance. Selected presentation to the Quantitative Biology meeting. Honolulu, HI. 2018.
3. **Kimmel JC**, Brack AS, Marshall WF. Deep neural networks for cell motility analysis. Presentation to Nvidia Deep Learning in Biomedicine Workshop. San Francisco, CA. 2018. *Nvidia Most Innovative Use of Deep Learning in Biomedicine Award.*
4. **Kimmel JC**, Chang AY, Brack AS, Marshall WF. Inferring stem cell states from cell motility behavior reveals a dynamic state system and broken detailed balance. Selected oral presentation to the Northern California Computational Biology Society. UC Santa Cruz, Santa Cruz, CA. 2017.
5. **Kimmel JC**, Chang AY, Brack AS, Marshall WF. Inferring cell state from cell motility behavior. Selected oral presentation to the NSF Quantitative Cell Biology Network Workshop. Allen Institute for Cell Science, Seattle, WA. 2016.

Service

- **Peer Reviewer:** *Bioinformatics*, *IEEE Journal of Biomedical & Health Informatics*, *Nature Medicine*, *PLoS Computational Biology*

Honors & Awards

- Nvidia Best Presentation Award, *Nvidia Deep Learning in Biomedicine*, 2018
- NSF Graduate Research Fellowship, $138,000/3 years, 2017
- PhRMA Foundation Informatics Fellowship, $40,000/2 years, 2017
- UCSF Discovery Fellowship, 2017
- Nvidia GPU Grant, 2017 & 2018
- NIH T32 Awardee, 2015
- Burnett Research Scholar, U. of Central Florida, 2013
- National Merit Scholarship, U. of Central Florida, (Full Tuition & Stipend), 2012-2015

REFERENCES

Wallace F. Marshall   Wallace.Marshall@ucsf.edu
Professor   UCSF

Andrew S. Brack   Andrew.Brack@ucsf.edu
Associate Professor   UCSF

Todd Nystul   Todd.Nystul@ucsf.edu
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Andrew G. York   agy@calicolabs.com
Principal Investigator   Calico Life Sciences

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