

## **ROBERT R. PUCCINELLI**

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### **EDUCATION:**

2010 – 2014

**B.S. Physics**, Biophysics

**B.S. Biological Sciences**, Microbiology and Immunology

**University of California, Merced**

Cumulative GPA: 3.675, STEM GPA: 3.754

### **RESEARCH EXPERIENCE:**

#### **Life Sciences Research Professional, Stanford University**

Sep. 2014 – *present*

Polly Fordyce, PhD; *Biophysical Microfluidics*

High-Throughput Analysis of DNA-Protein Biophysical Interactions

My research in the Fordyce Lab is centered around employing the MITOMI microfluidic device, a multiplexer with >1500 sample chambers that mechanically traps molecular interactions, for high throughput investigations of transcription factor – DNA oligo binding equilibrium and kinetics to access finer resolution data that is not readily observed in other systems such as ChIP-seq. To accomplish these objectives, I assembled hardware for these systems, prepared the supplies consumed in each experiment, wrote software to manipulate and analyze image datasets and trained other members.

#### **MATLAB Custom Script Implementation (Independently Written)**

- Updated microfluidic control scripts to permit MATLAB to control microscope and microfluidic devices
- Automated microfluidic device control and time series imaging protocol
- Decoupled stacked TIFFs to isolate fluorescent images of data and flat-field corrected images with MATLAB scripts before importing ImageJ to stitched as a complete image
- Processed complete image datasets with automated, high-throughput GUI for high content array analysis of TF-DNA binding events for >1500 isolated chambers. Reduced analysis from 2hrs to 15mins per dataset.

#### **Sample Preparation**

- PCR extended basic helix-loop-helix TF DNA such as MAX and c-Myc to include transcription/translation sites before cloning into a plasmid and transforming competent *E. coli* for expansion and sequencing
- Prepared DNA oligo libraries with a fluorescent tag before printing onto glass slides with DeRisi-style microarrayers with printing solutions that were optimized for our setups
- Fabricated two-layer MITOMI devices with PDMS and aligned to >1500 DNA spots on glass slide

#### **Instrumentation Assembly**

- Assembled, maintained and established communication for several epifluorescent microscopes with PCs employing open-source MicroManager microscope controlling software
- Constructed a DeRisi-style microarrayer and established connections for computer driven operation
- Constructed microfluidic pneumatic setups and established connections for computer driven operation

**Undergraduate Research Assistant, University of California, Merced**

Oct. 2011 – May 2013

Kara McCloskey, PhD; *Cardiac Tissue Engineering*

Influence of Nanoscale Topography and Electrical Stimulation on Stem Cell Fate

Stem cells that have not attained an adult-like state are unsuitable for clinical applications due to their propensity to revert to a multipotent state and induce tumorigenic growth. My research focused on differentiating mouse and human embryonic stem cells into immature cardiomyocytes and investigating the effects of surface topography and electrical pacing on advancing their maturation to an adult-like state. Generating mature cardiomyocytes would be a field-wide milestone in the path to restoring function to regions of the heart that has been irreversibly damaged by hypoxia.

**Tissue Culture**

- Maintained multiple lines of mouse and human stem cells including thawing, feeding, passing and freezing of cultures so that excess cells were always ready for experiments in the lab
- Directed differentiation of multiple lines of stem cells towards the myocardial lineage with physical techniques, such as embryoid body formation, chemical techniques, such as scheduled growth factor exposure and feeding, and environmental techniques, such as electrical stimulation
- Cultures were labeled with fluorescent antibodies or fluorescent fusion proteins and imaged with epifluorescent microscopy or FACS sorted

**Additional Responsibilities**

- Trained incoming students on cell culture, stem cell culture, and fluorescent microscopy to provide them with a basic skill set for their own projects
- Drafted experimental design for the project, directed and oversaw progress of the project, and discussed troubleshooting measures with my post-doctoral mentor
- Prepared and maintained reagent and media inventory

**Undergraduate Research Assistant, University of California, Merced**

Jan. 2013 – Oct. 2014

Ajay Gopinathan, PhD; *Computational Cellular Biophysics*

Influence of Nanoscale Topography on Actin Dynamics

f-Actin is a cytoskeletal element that plays significant roles in cell motility, endocytosis and defining cell shape by polymerizing against regions of the cell membrane with positive curvature. For my physics senior thesis, I modeled actin polymerization events at the cellular scale with a 2D, coarse-grained, nearest-neighbor Monte Carlo simulation whereby parameters for membrane-surface binding events, membrane curvature and elasticity, in addition to actin polymerization were used to evaluate cell shape modulation over time. This has predictive power for applications in tissue engineering where nano- and microscale topography is utilized to influence stem cell differentiation with cell shape.

**Computational Modeling**

- Constructed model for actin dynamics at the cellular level de novo by considering resistive and propulsive forces in the system including membrane bending, membrane adhesion and actin polymerization
- Generated different modes of actin dynamics such as cell spreading and cyclical actin wave generation by tuning parameters in the model
- Model was applied to different surface topographies to evaluate their influence on the localization of actin polymerization and cell shape
- Extracted relevant energetic and rate constants from the literature or set to a neighboring value

## PRESENTATIONS/POSTERS:

- September 2016      **2016 Stanford Department of Genetics Annual Retreat**  
Poster Presentation: Influence of Flanking Sequences in Transcription Factor - DNA Binding  
Robert R. Puccinelli and Polly M. Fordyce
- September 2015      **2015 Stanford Department of Genetics Annual Retreat**  
Poster Presentation: Resolving functional networks in a highly proficient enzyme  
C. Markin, R. Puccinelli, C. Guegler, F. Sunden, I. AlSadhan, P. Fordyce, D. Herschlag
- March 2014      **2014 Undergraduate Research Poster Competition, UC Merced**  
Poster Presentation: Modeling Actin Dynamics on Nanoscale Topography  
Robert R. Puccinelli and Ajay Gopinathan  
*\*Certificate of Achievement awarded for best poster presentation*
- March 2013      **Student Research Poster Competition, UC Merced**  
Poster Presentation: Roles for Electrical and Topographical Cues in the Maturation of Derived Cardiomyocytes.  
Robert R. Puccinelli, William S. Turner, Kara E. McCloskey
- August 2012      **Sixth Annual Summer Research Symposium, UC Merced**  
Poster Presentation: Combinatorial Effects of Nanoscale Topography and Electrical Stimulation in Stem Cell Fate  
Robert R. Puccinelli, William S. Turner, Kara E. McCloskey

## TEACHING EXPERIENCE:

**Microfluidic Device Design Laboratory, Stanford** Winter 2017  
Instructors: Steve Quake and Polly Fordyce  
Teaching Staff: Kara Brower, Diego Oyarzun, Adam White, Robert Puccinelli  
BIOE 301D/GENE 207

## AWARDS/HONORS:

- 2014      Graduation with Honors, *University of California, Merced*  
2014      Outstanding Student Award, *University of California, Merced*  
2014      Best Poster Presentation, *UC Merced Research Week 2014*  
2007      Eagle Scout, *Boy Scouts of America*

## INTERESTS:

- Biological-Microelectromechanical Systems
- Biomedical Microfluidics
- Biosensor Engineering and Development
- Field-Effect Transistors
- Instrumentation Programming and Control
- Mechatronics
- Optical Instrumentation
- Pathogen Detection and Identification