Sean A. Murphy

Cell Engineering · Bioinformatics Data Scientist

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Education

PhD in Biomedical Engineering

Baltimore, MD

Johns Hopkins University GPA: 4.0

Aug. 2015 — Feb. 2021

- Advisor: Dr. Chulan Kwon
- Heart Generation and Regeneration Laboratory

B.S. Bioengineering, B.A. Economics

Seattle, WA

University of Washington GPA: 3.84

Aug. 2011 — Jun. 2015

- Minor in Applied Mathematics
- *Magna Cum Laude*

International Baccalaureate Diploma

Kenmore, WA

Inglemoor High School GPA: 3.97

Sept. 2008 — Jun. 2011

Experience

Research Experience

Postdoctoral Research Fellow, Department of Cardiology, Johns Hopkins University

Jan. 2021 — Present

- Explored cell state stability related to cell fate reprogramming through multi-omic analysis.
- Investigated the role of key splicing factor in heart development and disease using a high-throughput robotic screen.
- Designed bioinformatics pipelines to rapidly perform upstream analysis of RNA-seq, ChIP-seq, and ATAC-seq.
- Created an engineered protein to treat atherosclerosis by reducing plaque size.
- Sequenced small RNA transcriptomes from multiple organs in time-series experiment then identified crucial miR for engineering stem cell-derived cardiomyocytes.

Graduate Research Assistant, Heart Generation and Regeneration Lab, Johns Hopkins University

Jan. 2016 — Dec. 2020

- Designed a research study to predict key transcriptional regulators of cardiomyocyte maturation and test their efficacy in promoting engineered heart tissue function.
- Analyzed single cell RNA-seq using custom pipeline and R to build a temporal transcriptome map of mouse heart development based on unsupervised learning clusters.
- Generated a genetic engineering system using adeno-associated virus to create a conditional mosaic knockout to understand the cell autonomous role of PGC-1a.
- Collaborated with researchers at UCSD to analyze ChIP-seq and ATAC-seq of fibroblast reprogramming into cardiomyocytes, yielding insights into reprogramming mechanism.
- Trained and supervised undergraduate students in cell culture, flow cytometry, and coding.

Undergraduate Researcher, Laflamme Lab, University of Washington

Apr. 2012 — Jun. 2015

- Developed immunohistochemistry protocols for GFP in paraffin-embedded tissue samples to visualize distribution of cell therapy graft in rat hearts.
- Localized Ribonucleotide Reductase in human pluripotent stem cell-derived cardiomyocytes grafted into rat hearts using immunostaining.
- Identified off-target effects of antiarrhythmic peptide rotigaptide on hPSC-CMs, showing viability of peptide to improve excitation contraction coupling of stem cell graft.

Work Experience

Bioinformatics Consultant, Vita Therapeutics

Sep. 2021 — Present

- Performed a multi-omic data analysis using AWS pipeline with the goal of constructing a cell therapy product for use in humans.
- Compared transcriptomes of cell isolation strategies for pluripotent stem cell-derived muscle satellite cells.
- Worked with CSO to design follow-up experiments to validate computational findings.

Consultant, PipeBio *Dec. 2021 — Apr. 2022*

- Identified new machine learning tools that would be useful to client base.
- Profiled novel technologies in recent literature that are relevant to the platform.
- Wrote analysis of the potential impact of a specific single cell sequencing system for rapid antibody profiling.

Chemistry Research Intern, Seattle Genetics *Jun. 2014 — Sep. 2014*

- Adapted protocol to magnetically isolate endosomes and lysosomes to characterize tumor microenvironment.
- Evaluated cytotoxicity and intracellular drug concentration of antibody drug conjugates across multiple cell lines and cancer indications.
- Investigated mechanism of action of novel antibody drug conjugates.

Business Development Intern, Knotis *Jun. 2012 — Sep. 2012*

- Worked at Seattle tech start up to improve product design of online small business tools and presented mobile strategy to leadership team.
- Designed marketing materials to increase client use of product following one-on-one meetings with local small businesses.

Global Marketing Intern, Microsoft *Aug. 2010 — Aug. 2011*

- Developed metric scorecards, interpreting business intelligence to management.
- Prepared and presented a competitive analysis presentation to the consumer engagement team.

Publications

Conserved transcription factors promote cell fate stability and restrict reprogramming potential in differentiated cells *2023*

Maria Missinato*, **Sean Murphy***, Michaela Lynott*, Michael Yu, Anais Kervadec, Yu-Ling Chang, Suraj Kannan, Mafalda Loreti, Christopher Lee, Prashila Amatya, Hiroshi Tanaka, Chung-Teng Huang, Pier Lorenzo Puri, Chulan Kwon, Peter Adams, Li Quan, Alessandra Sacco, Peter Andersen, Alexandre Colas *Nature Communications*

Cardiac progenitors instruct second heart field fate through Wnts *2022*

Matthew Miyamoto, Suraj Kannan, Matthew Anderson, Xihe Liu, David Suh, Myo Htet, Biyi Li, Tejasvi Kakani, **Sean Murphy**, Emmanouil Tampakakis, Mark Lewandoski, Peter Andersen, Hideki Uosaki, Chulan Kwon *PNAS*

Heart-on-a-chip platforms and biosensor integration for disease modeling and phenotypic drug screening *2022*

Joseph Criscione*, Zahra Razaei*, Carol Hernandez Cantu, **Sean Murphy**, Su Ryon Shin, Deok-Ho Kim *Biosensors and Bioelectronics*

Oxysterol misbalance critically contributes to Wilson disease pathogenesis *2022*

Som Dev, Abigael Muchenditsi, Aline Gottlieb, Pragney Deme, **Sean Murphy**, Kathleen Gabrielson, Yixuan Dong, Robert Hughes, Norman Haughey, James Hamilton, Svetlana Lutsenko *Science Advances*

Multi-organ in vivo maturation comparison identifies transcriptomic similarities *2022*

Sandeep Kambhampati*, **Sean Murphy***, Hideki Uosaki, Chulan Kwon *Journal of Computational Biology*

Heart neurons use clock genes to control myocyte proliferation *2021*

Emmanouil Tampakakis, Harshi Gangrade, Stephanie Glavaris, Myo Htet, **Sean Murphy**, Brian Leei Lin, Ting Liu, Amir Saberi, Matthew Miyamoto, William Kowalski, Yoh-Suke Mukouyama, Gabsang Lee, Liliana Minichiello, Chulan Kwon *Science Advances*

Maturing stem cell-derived cardiac muscle: mechanisms and transcriptomic insights *2021*

Sean Murphy*, Elaine Chen*, Kenneth, Boheler, Leslie Tung, Chulan Kwon *Seminars in Cell Developmental Biology*

Inhibition of phosphodiesterase type 9 reduces obesity and cardiometabolic syndrome in mice *2021*

Sumita Mishra, Nandhini Sadagopan, Brittany Dunkerly-Eyring, Susana Rodriguez, Dylan C Sarver, Ryan P Ceddia, **Sean Murphy**, Hildur Knutsdottir, Vivek Jani, Deepthi Ashok, Christian U Oeing, Brian O'Rourke, Kavita Sharma, Jon Gangoiti, Dorothy D Sears, G. William Wong, Sheila Collins, David A Kass *Journal of Clinical Investigation*

Noncanonical Notch signals have opposing roles during cardiac development — *2021*

Matthew Miyamoto, Peter Andersen, Edrick Sulistio, Xihe Liu, **Sean Murphy**, Suraj Kannan, Lucy Nam, William Miyamoto, Emmanouil Tampakakis, Narutoshi Hibino, Hideki Uosaki, Chulan Kwon — *Biochemical and Biophysical Research Communications*

PGC1/PPAR drive cardiomyocyte maturation through regulation of Yap1 and Sf3b2 — *2021*

Sean Murphy, Matthew Miyamoto, Anais Kervadec, Suraj Kannan, Sandeep Kambhampati, Brian Lin, Emmanouil Tampakakis, Sam Paek, Peter Andersen, Dong Lee, Steven An, David Kass, Hideki Uosaki, Alexandre Colas, Chulan Kwon — *Nature Communications*

Large particle fluorescence-activated cell sorting enables high quality single cell RNA-sequencing and functional analysis of adult cardiomyocytes — *2019*

Suraj Kannan, Matthew Miyamoto, Brian Lin, Renjun Zhu, **Sean Murphy**, David Kass, Peter Andersen, Chulan Kwon. — *Circulation Research*

Precardiac organoids form two heart fields via Bmp/Wnt signaling — *2018*

Peter Andersen, Emmanouil Tampakakis, Dennisse Jimenez, Suraj Kannan, Matthew Miyamoto, Helen Shin, Amir Saberi, **Sean Murphy**, Edrick Sulistio, Stephen Chelko, Chulan Kwon — *Nature Communications*

Neonatal transplantation confers maturation of PSC-derived cardiomyocytes conducive to modeling cardiomyopathy — *2017*

Gunsik Cho, Dong Lee, Emmanouil Tampakakis, **Sean Murphy**, Peter Andersen, Stephen Chelko, Khalid Chakir, Ingie Hong, Kinya Seo, Huei-Sheng Chen, Xiongwen Chen, Cristina Basso, Steven Houser, Gordon Tomaselli, Brian O'Rourke, Daniel Judge, David Kass, Chulan Kwon — *Cell Reports*

Cell-based delivery of dATP via gap junctions enhances cardiac contractility — *2014*

Lundy SD, **Sean Murphy**, Sarah Dupras, Jin Dai, Charles Murry, Michael Laflamme, Michael Regnier. — *J. of Molecular and Cellular Cardiology*

Teaching

Instructor of Regenerative Medicine — *Beijing, China*

Viax — *Oct. 2018 — Dec. 2019*

Lead Teaching Assistant — *Baltimore, MD*

Systems Bioengineering II Lab Course (BME 580.424) — *Jan. 2019 — May 2019*

Teaching Assistant — *Baltimore, MD*

Cell and Tissue Engineering Lab Course (BME 580.451) — *Aug. 2017 — Dec. 2017*

Conference Presentations

U2 snRNP component SF3B2 regulates contractility — *San Diego, CA*

Weinstein Conference on Cardiovascular Development and Regeneration — *May 2023*

Sean Murphy, Michaela Lynott, Crystal Martinez, Myo Htet, Daniel Lee, Christine Miller, Emmanouil Tampakakis, Alexandre Colas, Chulan Kwon

PGC1a drives cardiomyocyte maturation at the single cell level — *Baltimore, MD*

School of Medicine and School of Engineering Retreat at Johns Hopkins University — *Mar. 2022*

Sean Murphy

The role of PGC1a/PPAR in in vivo heart maturation and applications to stem cell therapy — *Baltimore, MD*

Institute for Cardioscience at Johns Hopkins University — *Nov. 2019*

Sean Murphy

Profiling microRNA expression during organ maturation — *Indianapolis, IN*

Weinstein Cardiovascular Development and Regeneration Conference — *May 2019*

Murphy SA, Sandeep Kambhampati, Chulan Kwon

Overcoming obstacles toward heart regeneration: maturing stem cells into cardiac tissue — *Baltimore, MD*

Partnering Towards Discovery Initiative — *Mar. 2019*

Sean Murphy, Suraj Kannan, Chulan Kwon

PPAR/PGC1a activation promotes pluripotent stem cell-derived cardiomyocyte maturation — *Nara, Japan*

Weinstein Cardiovascular Development and Regeneration Conference — *May 2018*

Murphy SA, Miyamoto MK, Kannan S, Andersen P, Uosaki, H, Kwon C.

Heart Fields Are Induced by Coordinated Activity of Wnt and Bmp Signaling and Identified by CD184 and EphA2 in PSC-Derived Organoids — *Anaheim, CA*

American Heart Association — *Nov. 2017*

Andersen, Peter, Dennisse Jimenez-Cyrus, Stephen P. Chelko, Suraj Kannan, Emmanouil Tampakakis, Amir Saberi,

Sean Murphy, Matthew Miyamoto, and Chulan Kwon

De novo reconstructed developmental trajectory of embryonic and post-natal hearts — *Columbus, OH*

Weinstein Cardiovascular Development and Regeneration Conference. — *May 2017*

Kannan S, Saberi A, **Murphy SA**, Kwon C.

Rotigaptide modulation of human pluripotent stem cell-derived cardiomyocyte maturation and proliferation — *Spokane, WA*

National Council on Undergraduate Research Conference — *Apr. 2015*

Murphy SA, Filice D, Zhu WZ, MA Laflamme

Quantification of Ribonucleotide Reductase in human embryonic stem cell derived cardiomyocyte cell therapy — *Seattle, WA*

Undergraduate Research Symposium — *May 2013*

Murphy SA, SD Lundy, M Regnier, MA Laflamme

Honors & Awards

2022 **Maryland Stem Cell Research Fund**, Postdoctoral Fellowship
2022 **Blumenthal Award**, Second Place
2021 **NIH T32 Fellowship**, Recipient
2019 **Turock Award**, Travel Scholarship
2018 **American Heart Association**, Predoctoral Fellowship
2017 **T Rowe Price Biotech Stock Pitch Competition**, First Place
2016 **NSF**, Graduate Research Fellowship
2015 **Dean's List**, 12-time recipient
2014 **Art Levinson Emerging Scholars Award**, Awardee
2014 **Mary Gates Research Scholarship**, Recipient
2014 **Phi Beta Kappa**, Inductee
2014 **National Undergraduate Global Health Design Competition**, Finalist
2013 **William P Wood Bioengineering Scholarship**, Awardee
2013 **Mary Gates Research Scholarship**, Recipient
2012 **Bruno Strauss Business and Engineering Scholarship**, Recipient
2011 **Washington Scholar**, Awardee
2011 **Knopp Aerospace Scholarship**, Recipient
2011 **Rusty Young Community Leader Scholarship**, Awardee
2011 **Seattle ACE Engineering Scholarship**, Awardee
2010 **DECA International Business Case Study Competition**, First Place
2010 **Boy Scouts of America**, Eagle Scout

Skills

Programming R, Bash, Python, MATLAB, LaTeX

Laboratory Single cell RNA seq, ChIP-seq, scATAC-Seq, qPCR, stem cell culture, flow cytometry, FACS, tissue and cell culture, mouse colony management, western blotting, fluorescent microscopy, paraffin embedded histology, molecular biology

Leadership and Volunteer Work

Thread

Head of Family *2015 — Present*

- Mentored 2 young adults to help them develop their careers and support them through life challenges.

Johns Hopkins Ultimate

Coach *2019 — 2021*

- Led competitive ultimate team in training and tournament play.

JH Biotech Investment Group

Member *2017 — 2020*

- Analyzed biotech companies and attended seminars on biotech investment.

Modern Board Game Society

President *2016 — 2020*

- Led student group that organizes events to play strategic board games.

BME PhD Council

Vice President of Communications *2016 — 2017*

- Manage communications for the BME PhD student organization.

Graduate Student Association

BME Representative *2015 — 2017*

- Served as liaison between BME PhD Council and JHU School of Medicine Graduate Student Association.

Book Thing of Baltimore

Volunteer *2015 — 2016*

- Organized used books for distribution to the Baltimore community.

Bioengineers Without Borders

Vice President and Project Lead *2011 — 2015*

- Developed ultrasound hydration monitor for use in low resource settings.
- Finalist at Rice 360 Institute for Global Health Technology Design Competition.

STEM Mentors

Co-founder and President *2013 — 2015*

- Identified need for and built STEM mentoring program at Seattle area high schools
- Planned collaborative design activities and presentations on STEM fields.

Roots Youth Shelter

Volunteer *2013 — 2015*

- 100+ hours of volunteer work in day-to-day operations at local youth shelter.

Engineering Ambassadors

K-12 Outreach Coordinator *2012 — 2015*

- Set up outreach events and represented UW College of Engineering at local events.

Bioengineering Outreach

Team lead *2013 — 2015*

- Organized and contributed to outreach events in Cardiovascular Engineering module at Seattle area high schools to generate interest in bioengineering careers.