



Chulan Kwon, Ph.D., M.S.

Titles & Department

Associate Professor of Medicine at the Heart and Vascular Institute,
Director of the Cardiovascular Stem Cell Program

Specialization Area

Stem cell biology and organoids to understand heart development, malformations, and regeneration.

Unmet Need

More detailed, mechanistic, and dynamic approach to understanding cardiac development and maturation to assist in therapeutic studies.

Summary of Research & Work

Dr. Kwon is an expert in and advocate for leveraging stem cell biology to understand maturation and disease to guide regenerative medicine. Having led the team that overcame the hurdle of arrested maturation in iPSC-derived in vitro heart cells, the Kwon lab is now focused on understanding cellular and molecular mechanisms of differentiation and regeneration. A recent novel discovery by the research group was in the field of transcriptomic benchmarking, using entropic approaches to compare iPSC-derived tissues against in vivo development to allow all scientists to understand what level of maturation stem cell-derived models recapitulate. Overall, the lab aims to address the high burden of heart disease in the United States with a developmental biology perspective. This approach encompasses two foci: (1) understanding the signaling pathways that induce, maintain, and differentiate diverse heart cells in health and disease, and (2) identifying the factors and coordinate structural, functional, and metabolic maturation of cardiac myocytes. These foundational investigations platform therapeutic approaches, and the group's stem cell platform allows the additional development of models to study novel therapeutic approaches.

Value Proposition

- Broad foundational understanding of development.
- Functional, mature stem cell derived cardiac cells.
- Novel benchmarks of in vitro tissues in comparison to in vivo maturation.
- Structural organoids to study physical maturation.

Recent Publications

- Miyamoto M, Kannan S, Anderson MJ, Liu X, Suh D, Htet M, Li Biyi, Kakani T, Murphy S, Tampakakis E, Lewandoski M, Andersen P, Uosaki H, Kwon C. Cardiac progenitors instruct second heart field fate through Wnts. PNAS. December 22, 2022.
- Sun C, Kannan S, Choi IY, Lim H, Zhang H, Chen GS, Zhang N, Park SH, Serra C, Iyer SR, Lloyd TE, Kwon C, Lovering RM, Lim SB, Andersen P, Wagner KR, Lee G. Human pluripotent stem

cell-derived myogenic progenitors undergo maturation to quiescent satellite cells upon engraftment. *Cell Stem Cell*. April 7, 2022.

- Tampakakis E, Gangrade H, Glavaris S, Htet M, Murphy S, Lin BL, Liu T, Saberi A, Miyamoto M, Kowalski W, Mukoyama Y, Lee G, Minichiello L, Kwon C. Heart neurons use clock genes to control myocyte proliferation. *Sci Adv*. December 3, 2021.
- Kannan S, Farid M, Lin BL, Miyamoto M, Kwon C. Transcriptomic entropy benchmarks stem cell-derived cardiomyocyte maturation against endogenous tissue at single cell level. *PLoS Computational Biology*. September 17, 2021

Awards & Honors

- 2020 Maryland Stem Cell Research Commission Validation Award
- 2019 Johns Hopkins Discovery Award
- 2018 American Heart Association Established Investigator Award