Secrets of heart regeneration revealed by comparative analyses in fish models

Ben Lai, PhD

Abstract

Our laboratory performs comparative analyses in animals capable or incapable of heart regeneration to understand the cellular and molecular bases of this process. Particularly, zebrafish display a distinct ability to regenerate their heart following injury. However, this ability is not shared by another teleost, the medaka. Transcriptomic profiling revealed major differences in immune cell dynamics and gene expression between these models after cardiac injury. Functional experiments further showed that macrophage heterogeneity and functions are essential for zebrafish heart regeneration, while modulating immune response may enhance immune cell function and promote neovascularization, neutrophil clearance, cardiomyocyte proliferation, and scar resolution in medaka. Altogether, our research gains insights into the complex role of the immune response during heart regeneration and serves as a platform to identify and test novel regulators for therapeutic development.