



Abstract: C-MORE: A High-content Single-cell Morphology Recognition Methodology for Liquid Biopsies Toward Personalized Cardiovascular Medicine

Jennifer Furkel^{1,2,3,4,5}, Maximilian Knoll^{3,4,5}, Shabana Din^{1,2}, Nicolai V. Bogert^{1,2}, Timon Seeger^{1,2}, Norbert Frey^{1,2}, Amir Abdollahi^{3,4,5}, Hugo A. Katus^{1,2}, Mathias H. Konstandin^{1,2}

¹Department of Cardiology, Angiology and Pneumology, Heidelberg University Hospital, 69120 Heidelberg, Germany

²DZHK (German Center for Cardiovascular Research), Site Heidelberg/Mannheim, 69120 Heidelberg, Germany

³German Cancer Consortium (DKTK) Core Center Heidelberg, German Cancer Research Center (DKFZ), 69120 Heidelberg, Germany

⁴Clinical Cooperation Unit Translational Radiation Oncology, National Center for Tumor Diseases (NCT), Heidelberg University Hospital (UKHD) and DKFZ, 69120 Heidelberg, Germany

⁵Division of Molecular and Translational Radiation Oncology, Department of Radiation Oncology, Heidelberg Faculty of Medicine (MFHD) and Heidelberg University Hospital (UKHD), Heidelberg Ion-Beam Therapy Center (HIT), Heidelberg, Germany
mathias.konstandin@med.uni-heidelberg.de

Cellular morphology has the capacity to serve as a surrogate for cellular state and functionality. However, primary cardiomyocytes, the standard model in cardiovascular research, are highly heterogeneous cells and thus impose methodological challenges to analysis. Hence, we aimed to devise a robust methodology to deconvolute cardiomyocyte morphology on a single-cell level: C-MORE (cellular morphology recognition) is a workflow from bench to data analysis tailored for heterogeneous primary cells using our R package cmoRe. We demonstrate its utility in proof-of-principle applications such as modulation of canonical hypertrophy pathways and linkage of genotype-phenotype in human induced pluripotent stem cell-derived cardiomyocytes (hiPSC-CMs). Exposure of cardiomyocytes to blood plasma prior to versus after aortic valve replacement allows identification of a disease fingerprint and reflects partial reversibility following therapeutic intervention. C-MORE is a valuable tool for cardiovascular research with possible fields of application in basic research and personalized medicine [1].

References

1. Furkel et al. C-MORE: A high-content single-cell morphology recognition methodology for liquid biopsies toward personalized cardiovascular medicine. *Cell Reports Medicine*. 2021.