

DPD simulation of the movement and deformation of single cells

L.V. Zhou¹, and †*M.B. Liu²

¹Institute of Mechanics, Chinese Academy of Sciences, Beijing 100190, China

²College of Engineering, Peking University, Beijing 100871, China

*Presenting author: mbliu@pku.edu.cn

†Corresponding author: mbliu@pku.edu.cn

Abstract

The ability to move and deform of a cell is an important biomarker which can be used to distinguish and sort between healthy and cancer cells. In this paper, a dissipative particle dynamics (DPD) model is presented to model the movement and deformation of single cells. The cell membrane is represented by a network of DPD particles connected by WLC springs. Firstly, biconcave discocyte RBCs are simulated, including RBC stretching, RBC in shear flow and multi-RBCs in Poiseuille flow in a tube. The obtained results agree with experimental observations. And then, a spherical shape cell through a constricted micro-channel is investigated by using the cell model without area restraint. The obtained patterns of cell deformation and movement are similar to experimental observations. Finally, we conclude that the presented DPD method with WLC spring can effectively model the movement and deformation of single cells.

Keywords: Dissipative particle dynamics, cell model, cell movement, cell deformation