Membrane shear elasticity as a possible factor determining the stability of spiculated red cells

Aleš Iglič

Faculty of Electrical and Computer Engineering (Chair of Physics), Tržaška 25, 61000 Ljubljana, SLOVENIA
Institute of Biophysics, Medical Faculty, Lipičeva 2, 61000 Ljubljana, SLOVENIA

SUMMARY

The biconcave discoid shape is the normal shape of red blood cells. Under various conditions these normal red blood cells may be transformed into spiculated red blood cells, called echinocytes. In this work a five parameter geometrical model was used in order to describe such nonaxisymmetrical echinocyte shapes. The expressions for the membrane elastic energy were derived. It was assumed that the stable echinocyte shape corresponds to the minimum of the membrane elastic energy. It was shown that by neglecting the membrane shear elasticity the calculated stable echinocyte shapes always have only one spicule. However, by taking into account also the membrane shear elastic energy the calculated stable echinocyte shapes have many spicula in agreement with experimental observations.