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Effect of the natural state of an elastic cellular membrane on tank-treading and tumbling motions of a single red blood cell[1] KEN-ICHI TSUBOTA, Chiba University, SHIGEO WADA, Osaka University, HAO LIU, Chiba University — A 2D computer simulation model was proposed for tank-treading and tumbling motions of an elastic biconcave red blood cell (RBC) under shear flow. The RBC model consisted of an outer membrane and an inner fluid; the membrane's elastic properties were modeled by springs for stretch/compression and bending to consider the membrane's natural state in a practical manner. Membrane deformation was coupled with incompressible viscous flow of the inner and outer fluids of the RBC using a particle method. As a result of simulations using the same initial RBC shape with different natural states of the RBC membrane, only tank-treading motion was exhibited in the case of a uniform natural state of the membrane, and a nonuniform natural state was necessary to generate the rotational oscillation and tumbling motion. In the range of simulation parameters considered, the relative membrane elastic force versus fluid viscous force was $\sim$1 at the transition when the natural state nonuniformity was taken into account in estimating the membrane elastic force.

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