Mechanics of Red Blood Cells and Human Diseases

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Systematic studies were carried out both experimentally and computationally to understand red blood cell (RBC) mechanics and biorheology, as well as the related disease pathogenesis. The biomechanics tools used include microfluidic devices, diffraction phase microscopy, tomographic phase microscopy, optical tweezers, atomic force microscopy, and micropipette aspiration. In parallel, multiscale models and simulations were developed and carried out at molecular, cellular and tissue/organ levels, which involved molecular dynamics (MD), dissipative particle dynamics (DPD), finite element method (FEM) and boundary element method (BEM). Detailed examples include *Plasmodium falciparum* malaria and heredity disorders such as sickle cell anemia. Emphases will be given on the latest experimental results obtained using microfluidic devices as well as the new simulation results performed with a two-component RBC membrane model, where the lipid-bilayer and the spectrin network are modelled separately.