Physical and biological aging of red blood cells

Marta Gironella[1] and Felix Ritort[1,2]

[1] *Physics School, Condensed Matter Physics Department, University of Barcelona, C/ Marti i Franques s/n, 08028 Barcelona*
[2] *Ciber-BBN Center for Bioengineering, Biomaterials and Nanomedicine, Instituto de Salud Carlos III, Madrid*

Abstract.

Red blood cells (RBC) are probably the most simple and abundant kind of cells in mammals. Mature RBC are not considered living cells but sacks mostly containing hemoglobin that are surrounded by a plasma membrane containing the inner layer cell cortex, a meshwork of spectrin and others fibrous proteins that determines its mechanical properties. The main metabolic activity of RBC is the steady ATP-production from glucose along the glycolysis pathway, apparently leading to a nonequilibrium steady-state state which, however, slowly ages (*in-vivo* and *in-vitro*) due to accumulated alterations such as oxidative stress, osmotic imbalance, membrane vesiculation and shrinkage, etc.. Here we have investigated the time-dependent mechanical response of red blood cells by deforming the plasma membrane in *in-vitro* optical tweezers assays. We have determined the characteristic relaxational timescales for RBC shape recovery in a series of experimental protocols such as force-jump and repeated stretching-releasing cycles. We report on memory and physical aging effects in the experiments and discuss the relation between such effects and biological aging.