Photoacoustic effect applied on cell membranes: Direct observation by multi-photon laser confocal microscopy

SY02-02

F. Galisteo González[I,II], B. Gutiérrez Monasterio[I], F.M. Goñi[I]

[I]Instituto Biofisika, Leioa (Bizkaia), Spain, [II]University of Granada, Granada, Spain

The photoacoustic effect consists of the formation of sound waves following light absorption by a material upon exposure to a short and intense light pulse. With highly-absorbing materials, the pressure wave can be strong enough to cause mechanical distress in soft matter e.g. cell membranes. Carbon nanoparticles can be used to exploit this effect, as they absorb light very intensively in the infrared region and emit powerful pressure waves. By using a multi-photon confocal laser microscope, in which we can irradiate the sample with different laser wavelengths, we have directly observed and recorded this effect in human red blood cells and Chinese hamster ovarian cells. At low energy, these mechanical shocks cause disruption of cell membrane integrity, opening transient pores through which compounds of interest may be internalized before the gaps in the membrane are self-repaired. At higher energies nevertheless the number and/or extension of the pores seem to be excessive for the cell to survive, and an irreversible process of death is started. This technique opens an interesting field of study on the photoacoustic effect in micro- and nano-systems, and its possible technological applications.