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Título: The role of spatiotemporal heterogeneity in the regulation of cellular function

Molecular organization and diffusion regulate numerous processes underlying biological functions in living cells. In the last decade, advances in single-molecule fluorescence and super-resolution nanoscopy have allowed the visualization of cellular components at unprecedented spatial and temporal resolution, providing novel insights on a variety of cellular processes. These experiments have revealed that the complexity of the cellular environment often produces large heterogeneity both at the structural and dynamical level, whose implications for the cellular function are not fully understood.

Based on recent experimental results [1-3], I will present two examples of function regulation in living cells influenced by spatial and/or temporal heterogeneity. The first involves the structure of chromatin inside the cell nucleus, controlling the regulation of gene expression and the access of transcriptional factors to genes. By means of stochastic optical reconstruction microscopy (STORM), we have visualized the organization of histone proteins in the nucleus of mammalian cells and found that the nucleosomes are arranged in heterogeneous groups, displaying a broad distribution of composing units, sizes and densities [1]. Importantly, the comparison

of this organization in stem and somatic cells shows that these properties are correlated with the degree of pluripotency, i.e. the cell propensity to differentiate.
Second, I will discuss the organization and dynamics of DC-SIGN, a transmembrane pathogen-recognition receptor involved in the capture of viruses, bacteria and parasites. By combining stimulated emission depletion (STED) microscopy and single particle tracking, we have found that DC-SIGN displays a multiscale organization in the cell membrane [2]. In addition, its motion deviates from a purely Brownian behavior, exhibiting anomalous diffusion with signatures of weak-ergodicity breaking and aging [3, 4]. The comparative investigation of receptor mutants allowed us to correlate the receptor's motion with molecular structure and function, thus establishing a link between nonergodicity and DC-SIGN capability in pathogen capture and internalization.

References:

1 M.A. Ricci, C. Manzo, M. F. Garcia-Parajo, M. Lakadamyali, M.P. Cosma *Cell* (2015) 160(6):1145–1158.
2 J. A. Torreno-Pina, B. M. Castro, C. Manzo, S. I. Buschow, A. Cambi, M. F. Garcia-Parajo *Proc. Natl. Acad. Sci. U.S.A.* (2014) 111(30):11037–11042.
3 C. Manzo, J. A. Torreno-Pina, P. Massignan, G. J. Lapeyre Jr, M. Lewenstein, M. F. Garcia-Parajo *Phys. Rev. X* (2015) 5:011021.
4 P. Massignan, C. Manzo, J. A. Torreno-Pina, M. F. Garcia-Parajo, M. Lewenstein, G. J. Lapeyre Jr *Phys. Rev. Lett.* (2014) 112(15):150603.