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Afm-based Investigation of Cholesterol Impact on Topographic & Mechanical Properties of Biomimetic Cell Membranes, and Their Mutual Interaction with Extracellular Vesicles

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In the last decades, keen attention has been dedicated to the study of cell plasma membranes (PM), which represent the pivotal step of interaction with extracellular systems, such as vesicles (EVs), pathogens and drugs. Among the great biochemical heterogeneity of PM, cholesterol is currently acknowledged as one of the fundamental players regulating membrane stability, dynamics and mechanical properties. These, in turn, are widely recognized as an important biomarker of the patho-physiological state of biological specimens, thus being worth a quantitative characterization.

Here we will first present our preliminary AFM-based nano-topographic & mechanical measurements on supported lipid bilayers (SLBs) obtained with a mixture of 4 lipids (DOPC, DSPC, SM and variable concentration of cholesterol). We then exposed our SLBs to EVs expressing spike proteins as a mimicking tool for SARS-Cov2 virions, highlighting the relevance of cholesterol in ruling not only the topographic and mechanical properties of lipid rafts, but also the dynamics and mechanisms of EVs/SLBs interaction.

Altogether, our results aim to get a more detailed insight about the key biophysical properties ruling cellular membrane functioning, as a first step for potential applications in the theranostic field, such as novel drug-delivery strategies or cancer therapies targeting the membrane lipidic composition.