Biological Fate and In vivo Degradation Studies of Hybrid Nanomaterials for Drug delivery

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Abstract

Nanoformulations offer multiple advantages over conventional drug delivery, enhancing solubility, biocompatibility, and bioavailability of drugs.[1] Following systemic delivery nanocarriers must deliver encapsulated drugs, usually through nanocarrier degradation. A premature degradation or the loss of the nanocarrier coating may prevent the delivery of drugs to the targeted tissue. Despite their importance, stability and degradation of nanocarriers in biological environments are seldom studied in literature. Understanding fate and how nanomaterials change in biological matrixes is also fundamental for their toxicological evaluation as changes in nanoparticles surface or release of ions or molecules can induce toxicological endpoints. One of the main areas of research in our group in the last years has been the study of the fate of nanomaterials, aiming to understand how their properties change in biological environments-.In this presentation issues related to the biological fate and stability of nanocarriers in biological matrixes will be discussed: the interaction of the nanocarriers with proteins, the biodistribution of the nanocarriers, their biological fate, the kinetics of drug release in vitro/in vivo and the stability of the core and surface coating of the nanocarriers. Different types of nanomaterials will be discussed: poly lactic co glycolic nanoparticles[2], polymersomes[3], polyplexes for siRNA delivery[4], and mesoporous silica nanoparticles[5]. In vitro, we will make use of Fluorescence Correlation Spectroscopy for studying nanocarriers stability, the fate of protein corona after translocation and the relation between surface chemistry, protein corona formation and the aggregation of nanocarriers intracellularly. In vivo, we will apply Positron Emission Tomography and Single Photon Emission Tomography to study the biodistribution of nanocarriers, the stability of surface coatings and nanocarrier dissolution, making use of advanced radiolabeling strategies.

References

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Figures

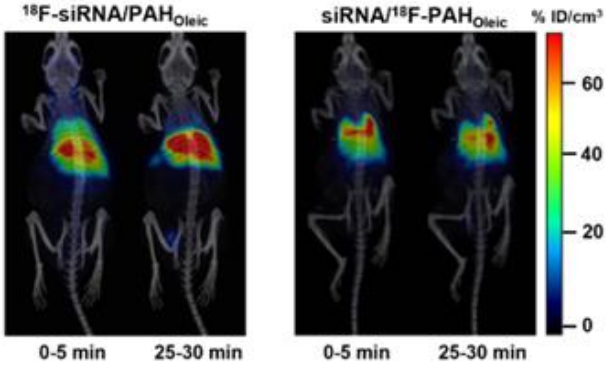

Figure 1. PET images of the biodistribution ^{18}F-siRNA/polyamine and siRNA/^{18}F-polyamine polyplexes. From the comparison of the two images the stability of the polyplexes is assesed.