In vivo biodistribution of siRNA-supported by polymer nanoparticles using Positron Emission Tomography (PET) imaging

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After the emergence of nanotechnology, many different types of nanoparticles (NPs) are being used in the biomedical field to encapsulate drugs that are not suitable for direct delivery. Several strategies have been used for the encapsulation of drugs using NPs, where the drugs can be linked to the core or surface of the NP by covalent, electrostatic or hydrogen bonding interactions. In recent years, small interfering RNA (siRNA) has emerged as a promising treatment strategy for various genetic diseases. However, siRNA is readily degraded after administration into the blood stream. Such degradation can be retarded by using appropriate drug delivery systems. One possible strategy is the use of NPs based on the self-assembly of polyamines and phosphate ions. Here, we describe the use of poly(allylamine hydrochloride) (PAH) as a carrier of siRNA and the application of radiollabelling followed by Positron Emission Tomography (PET) imaging to study its biodistribution *in vivo*. The ^{18}F-labelled SiRNA was prepared by the reacting the amino group-modification of siRNA with 6-[^{18}F]fluoronicotinyl-2,3,5,6-tetrafluorophenyl ester ([^{18}F]FPy-TFP), which was prepared as previously reported [1]. *In vivo* PET Imaging studies in rodents after intravenous administration clearly showed a different biodistribution between free [^{18}F]-siRNA, which was rapidly eliminated via urine, and PAH/[^{18}F]-siRNA nanoformulations, which showed significant accumulation in the liver, the spleen and the lungs (Fig. 1).

References

[1] Olberg, D., Arukwe, J. M., Grace D., et. al., J. Med. Chem., 2010, 53, 1732-1740

Figures

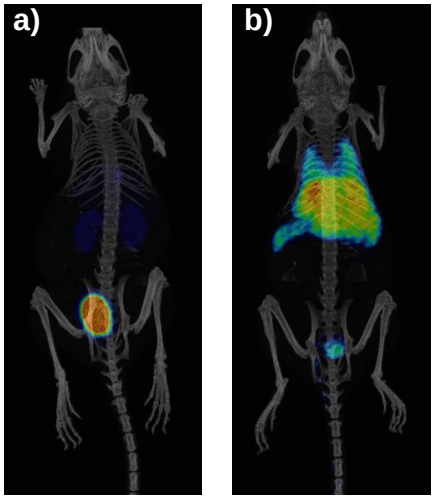

Figure 1. In vivo biodistribution studies of a) [18F]siRNA, and b) PAH/[18F]SiRNA in healthy mice using PET-CT. Images show the biodistribution after intravenous administration at time 30 min.