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# Small and biocompatible coatings for lymph node metastases detection and treatment

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## Introduction

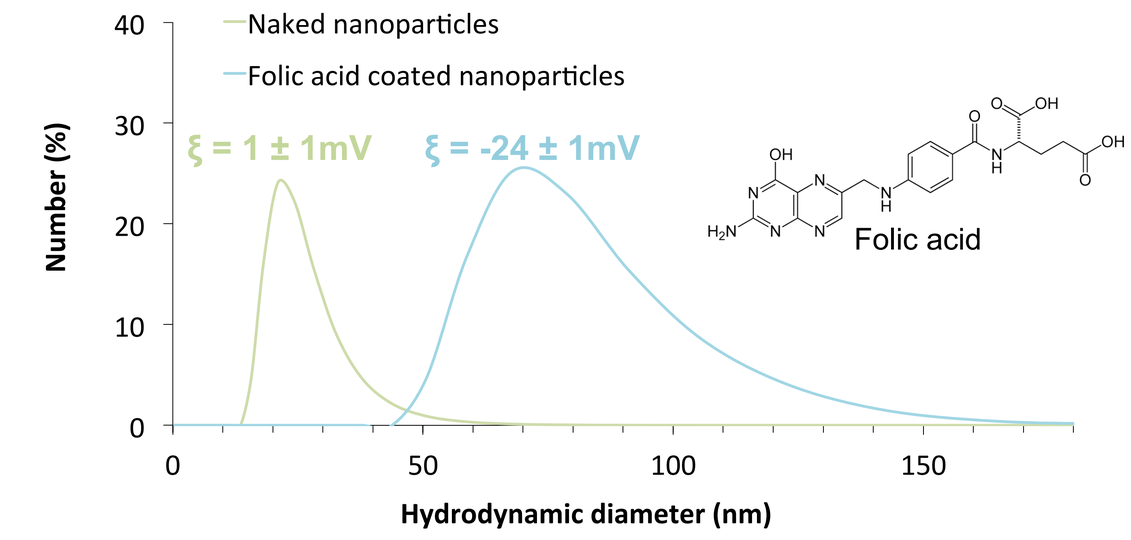
**Iron oxide nanoparticles (IONPs)** are stabilized in water by steric (coating by large molecules, e.g. polymers, sugars) or electrostatic repulsion (coating by charged molecules). However, the use of large molecules reduce the MRI relaxivity and heat transfer for the hyperthermia treatment. In addition, due to the typically large sizes (over 100nm), the IONPs do not remain in lymphatics.

We chose 11 different small and biocompatible coatings with groups having strong charges. For the 11 coating strategies, we did full physico-chemical and *in vitro* biological characterizations. Here is presented one example of these 11 coatings: folic acid.

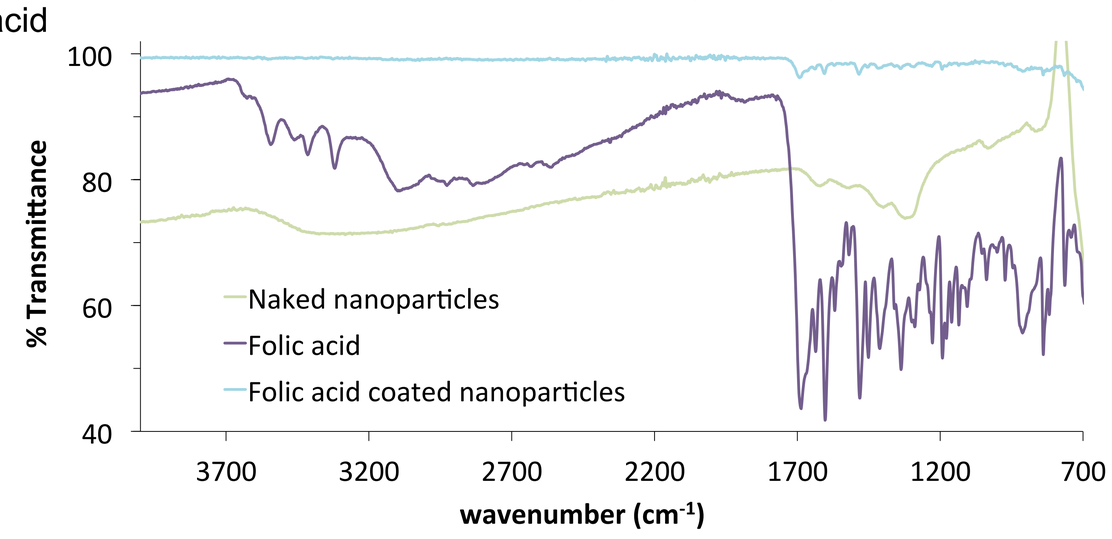
## Results

### Physico-chemical characterization

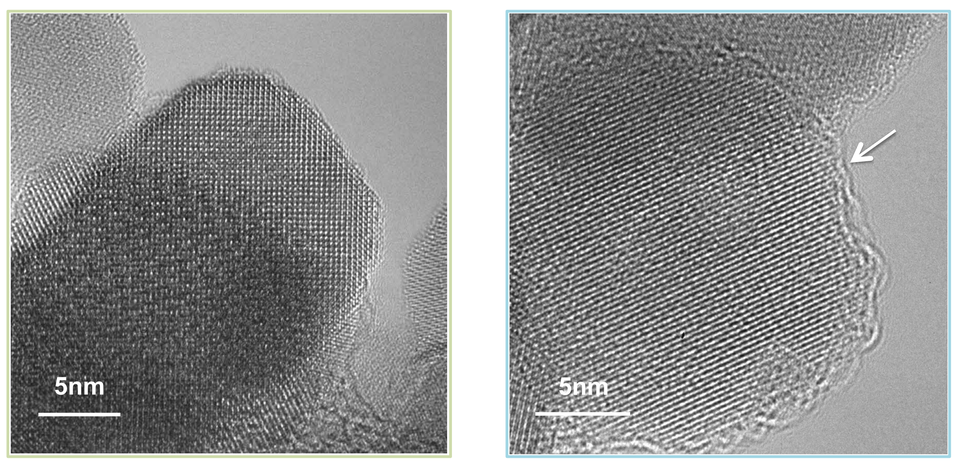
Folic acid-coated IONPs with hydrodynamic size below 100nm and negative surface potential ξ, which was shown as optimal for lymphatic access and retention




Fourier transform infrared spectroscopy (FTIR) showing the presence of folic acid

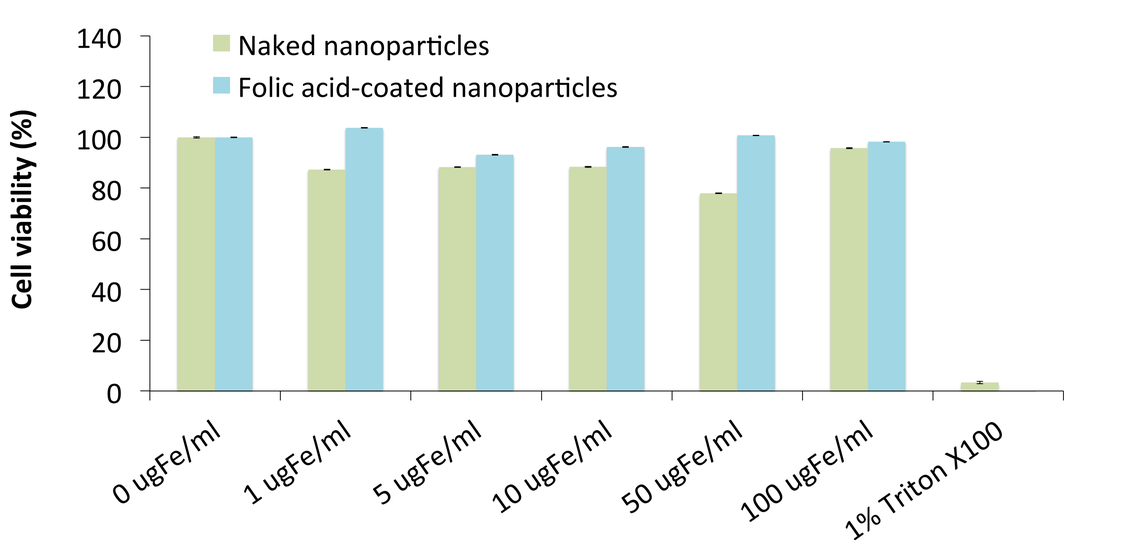



High resolution transmission electron microscopy (TEM) showing the arrangement of folic acid molecules in 2-3 layers around IONPs

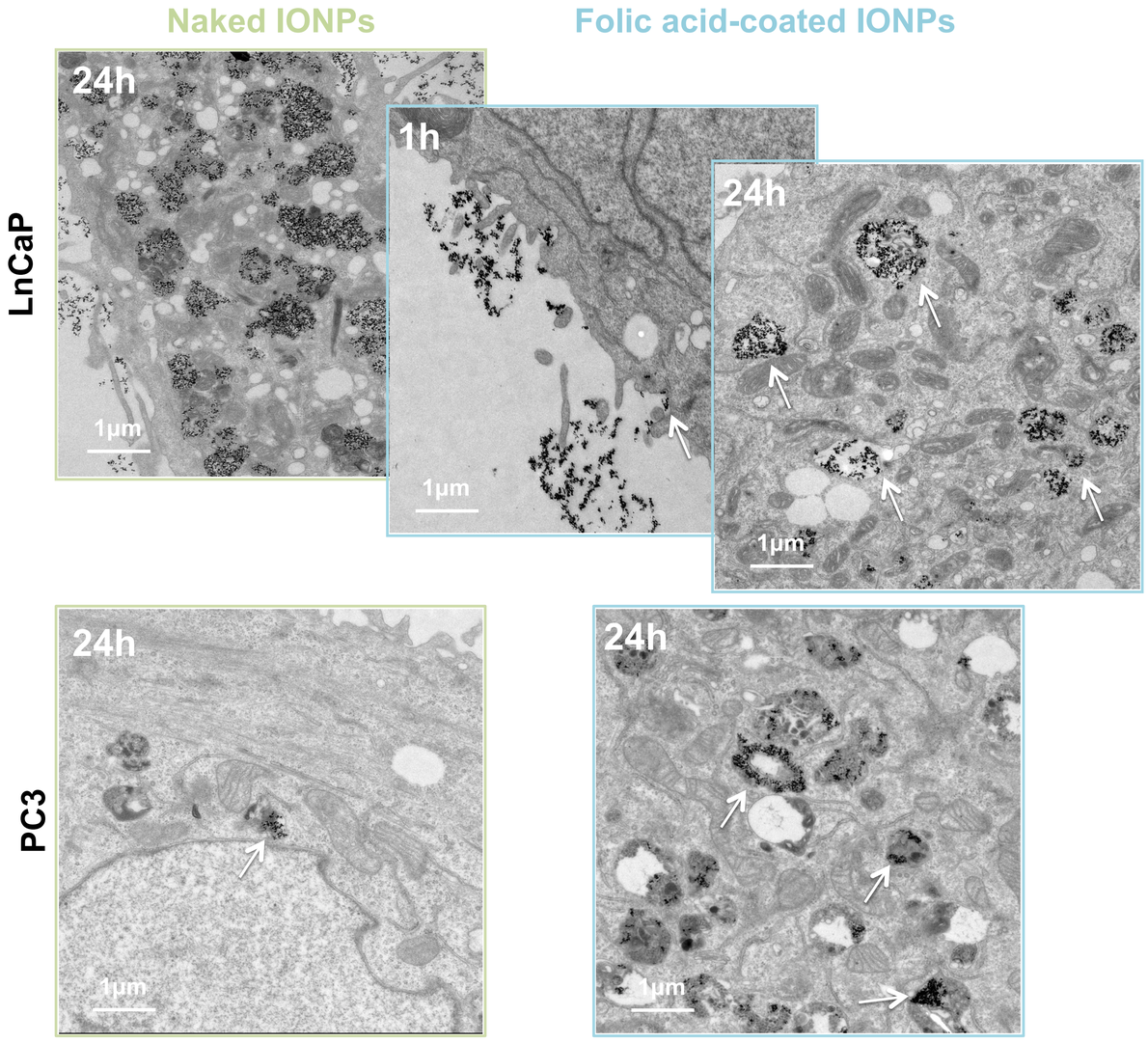



### *In vitro* biological characterization

*In vitro* viability of LnCaP cells (cells of lymph node metastases of prostate cancer) incubated for 24h with 0.1mgFe/ml IONPs, showing no or very low toxicity of folic acid-coated IONPs in a wide concentration range




TEM micrographs of LnCaP and PC3 cells (cells of bone metastases of prostate cancer) incubated for 1h and 24h with 0.1mgFe/ml IONPs (arrows indicate IONPs visible as black dots)




## Conclusions

We report the coating of IONPs with small and biocompatible molecules (11 strategies). We measured a size and surface zeta potential of folic acid-coated IONPs, which are optimal for lymphatic access/retention. *In vitro*, we observed very low toxicities of IONPs and very different cellular internalization profiles between naked and coated IONPs in LnCaP and PC3 cells, which can change their biological behaviour and response to the treatment.