Nanomaterials across the blood brain barrier for Neurodegenerative disease, glioma and as antiviral

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Major obstacles for an effective delivery of drug to specific diseased organs are mainly of physical or biological nature. Especially the blood brain barrier presents a nearly insurmountable hurdle for the passage of drugs from blood to brain[1] even if in disease often the BBB integrity is hampered[2].

In the presented work, it was shown that proteins - from the corona that forms on nanoparticles (NP) in contact with body fluids - can be a driver to a targeted delivery of the nanoparticles to a specific organs such as the lungs for improved drug delivery in case of tuberculosis or the brain for treatment of neurodegenerative diseases. Learning from nature it was possible by using this protein-driven targeting to increase the accumulated faction in the lungs up to 30% of the injected NP dose and to increase the amount in the brain by a factor of 150 compared to uncoated gold NPs of the same size[3]. Moreover, we will show that functionalized NPs are also promising candidates as drug for neurodegenerative disease exemplarily shown for prion disease[4,5].

Nanomaterials is also well-known as promising contrast agent for magnetic resonance imaging[6] mainly for liver disease but also as enhancer for magnetically induced hyperthermia in brain cancers. By additional functionalization, it is possible to use the magnetic nanoparticles both as multimodal imaging agens to aid the surgeon during tumor removal and in parallel as drug delivery system to localize and treat invading tumor cells in the environmental tissue.

Finally, we will show the potential of nanoparticles to interact in manifold ways with different types of viruses. They can either act as highly efficient antiviral, or enhance or stabilize the virus[7], which has a potential application in gene therapy or vaccines.

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