Gold nanoparticles (AuNPs) can behave as nanosources of heat under illumination with light at a frequency close to the frequency of the surface plasmon oscillation. In the field of medicine, AuNPs are already commercialized,[1] as nanosources of heat, for applications such as photothermal therapy, bio-imaging or drug delivery.

The heating efficiency of AuNPs is determined by: (1) the amount of light intensity reaching the NP inside a human body, which is maximized in specific wavelength domains where the attenuation of biological tissue is limited (first domain: [700–950 nm]), and by (2) the absorption cross-section which depends on the size (σ_{Abs} α (NP radius)^3), shape and material properties of the NP. Optimizing the heating efficiency by upscaling the size of nanoparticle is not a viable option as they become increasingly inefficient absorbers (the scattering cross section σ_{Scat} α (NP radius)^6). Moreover, from a biological point of view, increasing the nanoparticle diameter is detrimental for nanoparticle biodegradation and elimination from the body due to unfavorable surface/volume ratio.[2]

A viable option to solve this problem of optimization would consists to self-assemble small NPs into nanometric clusters.[3,4] To our knowledge, few studies were dedicated so far to this option because it remains a challenge to assemble in aqueous solution metal nanoparticles (NPs) into nanometric clusters with a well-defined structure using biocompatible components.

I will present a new strategy for assembling AuNPs into nanometric clusters with various structures based on electrostatic complexation between long polyelectrolyte chains and oppositely charged AuNPs.[5] A detailed structural study of the clusters will be first presented based on SAXS and cryo-TEM observations for different diameters of AuNPs (D = 4, 13 and 40 nm). In a second part, we will correlate the cluster's structures with UV-Visible spectroscopy and photothermal measurements for the different NP diameters in simple buffer solutions. In a last part, a set of results (structure and photothermal measurements) obtained after NP' internalisation in two types of human fibroblasts (one presenting a lysosomal disorder (cystinosis) and a healthy one) will be presented and compared to reference measurements in simple solutions.

References
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