Seeing and delivering drugs deep inside the body

Marta Cerruti

Materials Engineering, McGill University, Montreal, Canada

Much research focused on nanoparticle (NP)-based systems that carry both therapeutic and diagnostic (theranostic) modalities. In theranostic systems, on-demand drug delivery at a specific site can be triggered by various stimuli. Among them, light stands out due to its non-invasiveness, high local precision and temporal resolution. However, high energy ultraviolet (UV) or visible (VIS) light is required for most of the photoreactions to occur. These wavelengths cannot deeply penetrate inside the body, and UV light is also carcinogenic and can induce tissue damage. These drawbacks can be avoided using near-infrared (NIR) light, which is safe and can penetrate in the body up to several cm. To produce the UV light necessary to initiate a photoreaction, one would need a transducer that can convert NIR to UV radiation in situ. Rare earth doped upconverting NPs (UCNPs) can act as these transducers. UCNPs can (up)convert longer wavelengths NIR radiation to shorter wavelength UV, VIS and NIR radiation, thanks to the multiple long-lived 4f electronic states which allow two (or more) low energy photons to be sequentially absorbed and converted to a higher energy photon.

In this presentation we will discuss the use of UCNPs as both imaging probes and drug delivery vehicles, showcasing their potential as nano theranostics.