Luminescent Nanoparticles in detection and triggered drug release

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Nanoparticles provide ideal platforms for imaging and detection based on their inherit multimodality, size tuning for spatial localisation and surface chemistry for functionalisation. We have explored functionalisation of the nanoparticle network by two approaches: surface properties of gold nanoparticles and network structure of silica particles.

Gold nanoparticles, AuNP, offer a unique opportunity to incorporate multiple molecular luminescent complexes into a single nanoprobe architecture for signal detection without engaging in lengthy synthetic procedures for the incorporation of multiple labels. We have employed AuNP as a scaffold for luminescent coordination complexes so that the nanoprobes bear the distinct optical signature of the luminescent agent, independent of the properties of the particle (Fig 1).[1] We have studied their detection in monitoring blood flow, imaging in platelets and cancer cell lines using time-resolved and multiphoton imaging techniques.[2]

The silica network offers versatility in both functionalization on the surface and encapsulation of drugs in the interior of the particle to tailor detection and delivery.[3] We have recently explored the triggered delivery of antibacterial agents (CPC) by ultrasound in dental tissues using silica nanoparticles (SNP) and studied their potential uptake in bacteria cells (Fig. 2).[4]

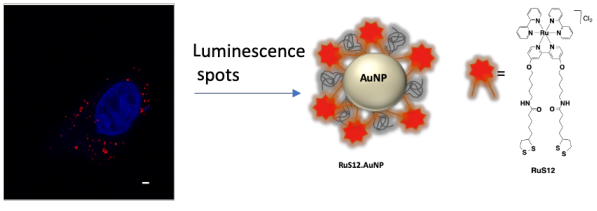

Fig.1 *AuNP as luminescent agents.*

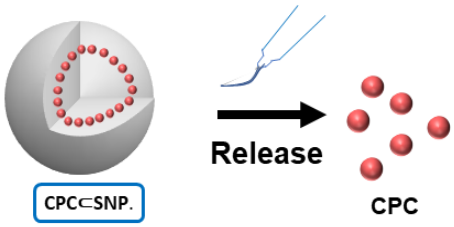

Fig. 2 *SNP for triggered delivery in dental tissues*

[1]A.B Caballero, L. Cardo, S. Claire, J.S. Craig, L. A. Rochford, N.J. Hodges, Z. Pikramenou, M.J. Hannon *Chem.Sci.* **2019**, 10, 9244; S. Osborne, Z. Pikramenou *Faraday Discuss.* **2015**, 185, 219. [2]A.N. Dosumu, S. Claire, S.A.M. Osborne, L. Watson, Z. Pikramenou and N.J. Hodges, *JACS Au*, **2021**, 1, 174; S. M. King, S. Claire, R. I. Teixeira, A. N. Dosumu, A J. Carrod, H. Dehghani, M. J. Hannon, A. D. Ward, R. Bicknell, S.W., Botchway, N. J. Hodges, Z. Pikramenou *J. Am. Chem. Soc*. **2018**, 140, 10242; N.J Rogers, H.C. Jeffery, S. Claire, D. J Lewis, G. Zikeli, N. J. Hodges, S. Egginton, G. B Nash, Z. Pikramenou *Nanomedicine* **2017**, 12, 2725. [3]D. J. Lewis, V.Dore, N. J. Rogers, T. K. Mole, G. B. Nash, P. Angeli, and Z. Pikramenou, *Langmuir* **2013**, 29, 14701. [4] M. M. Manhota, S.A. Kuhne, A. D.Walmsley, Z. Pikramenou manuscript to be submitted; A.Rodriguer-Muguruza, A. Di Maio, J.A.M. Blair, Z. Pikramenou manuscript submitted.