Expanding the Synthetic Methodology of *N*-Heterocyclic Carbene Protected Gold Nanoclusters and Altering their Properties for Biomedical Application

Atomically precise gold nanoclusters (AuNCs) are an exciting and growing class of nanomaterials with applications in catalysis and biomedicine. Since first reported by our group in 2019, AuNCs fully protected with N-heterocyclic carbenes (NHCs) have garnered attention due to their high stability and favourable optical properties when compared to nanoclusters stabilized by traditional thiolate and phosphine ligands. However, their recent discovery has left the field underdeveloped in comparison to those ligands. This presentation will detail insights into the synthesis of these AuNCs via the traditional reduction of gold complexes using sodium borohydride, and the use of KC_8 as a strong $1e^-$ reducing agent to form the only reported Au_{11}-nanocluster fully protected with monodentate NHC ligands, $[Au_{11}(NHC)_8Br_2]Br$. The characterization and properties of this AuNC will be described. Furthermore, the synthesis and characterization of water soluble AuNCs for biomedical applications will be discussed. This was accomplished by the incorporation of triethylene glycol monomethyl ether groups to the backbone of the NHC ligand. These nanoclusters demonstrated high water solubility and unprecedented quantum yields in water. Finally, the functionalization of these water soluble NCs with azide groups and their use in click reactions and application will be discussed.