Synthesis and photophysical studies of nitrogen heterocycles

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Nitrogen heterocycles such as quinolines, benzothiazines, benzothiazoles, and indoles are widely found in nature and these compounds have significance in organic and medicinal chemistry, biochemistry as well as materials science. Following our interest in studying the photophysical properties of viologens (dicationic salts of 4, 4’-bipyridinium), gold-heli viologen was synthesized and characterized successfully using Pd(0)-catalyzed Stille coupling route (22% in 5 steps) from 3-bromoquinoline. Temperature variable photoluminescence and quenching experiments were performed to study the photophysical behaviour. In addition, eumelanoids were synthesized and regioselectively functionalized using thermally induced nitrene insertions, and pheomelanoids were synthesized using Cu(II)-catalyzed thiolation and Ullmann coupling. Utilizing these melanin building blocks, synthesis of mixed melanoids was done using Miyaura borylation and Suzuki-coupling. A library of melanoids was synthesized in order to investigate the structure and biological activity, with a focus on neuromelanin multimers, which could serve as a bio-marker in Parkinson’s disease. Finally, applications of these nitrogen heterocycles for use in optical memory, semiconductors, and electro-optic devices will be discussed.