Photodynamic therapy (PDT) has its history in ancient Egypt and Asia but its modern use began in the late 1800s. It was then dominated by porphyrins and their derivatives for many years. Recent advances in photochemistry however have increasingly seen the use of transition metals in PDT. Transition metal complexes typically absorb light efficiently in the visible region in a one-photon absorption process, and often possess high two-photon absorption cross-section in the NIR region. The presence of a heavy atom promotes spin-orbit coupling leading to ultrafast (usually < 1 ps) and efficient (often close to 100%) population of triplet excited states. The high yield of triplet excited states leads to generally high yields of singlet oxygen generation. On the other hand, long emission lifetimes make TM complexes sensitive to the intracellular microenvironment – thus potentially offering combined “see and cure” agents. Contrary to the majority of coloured organic compounds, TM complexes are usually photostable (i.e., do not photobleach) under prolonged one- and two-photon illumination, which allows for the prolonged recycling of the PS and hence an overall reduction in the PS dose required. Added to these attractive photo-physical properties is the relative ease with which TM complexes can be synthesised, where several ligands and metal centres can be combined in an almost combinatorial fashion, offering an opportunity to tune their photophysical properties as required.

Here a brief history of PDT will be presented followed by some of our own work on the use of transition metal complexes in PDT drug development.