Diiron Bis-Cyclopentadienyl Complexes: from Fundamental Organometallic Chemistry to Unveiling Anticancer Potential

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A range of organometallic structures can be synthesized from $[Fe_2Cp_2(CO)_4]$ (Cp = η^5-C_5H_5) through sequential displacement of carbonyl ligands, yielding diiron complexes with bridging hetero-carbyne or vinyliminium ligands. These compounds exhibit rich and versatile chemistry [1]. Furthermore, they possess favourable pre-requisites for drug development, including multigram-scalable synthetic procedures, a balanced amphiphilic profile, stability in aqueous media, and broad structural variability, enabling fine-tuning of their physicochemical and biological properties. Optimized derivatives from these families have shown potent cytotoxicity against cancer cell lines, linked to the disruption of cellular redox homeostasis, along with significant selectivity over normal cells, see Figure 1 [2]. Notably, two lead compounds have demonstrated promising anticancer efficacy in vivo [3].

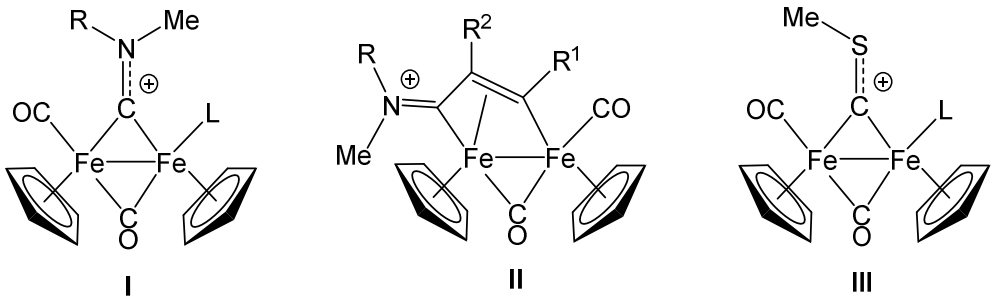

Figure 1. General structures of diiron complexes ($CF_3SO_3^-$ salts) with documented anticancer activity, featuring a bridging aminocarbyne (**I**), vinyliminium (**II**) or thiocarbyne ligand (**III**). R = alkyl or aryl; R^1 = alkyl, aryl, carboxylate, pyridyl and others; R^2 = H, alkyl, Ph, carboxylate; L = CO, pyridine, isocyanide, phosphine.

References

[1] Biancalana, L.; Marchetti, F. *Coord. Chem. Rev.*, **2021**, *449*, 214203.

[2] See for instance: Bresciani, G.; Cervinka, J.; Kostrhunova, H.; Biancalana, L.; Bortoluzzi, M.; Pampaloni, G.; Novohradsky, V.; Brabec, V.; Marchetti, F.; Kasparkova, J. *Chem.-Biol. Interact.* **2023**, *385*, 110742.

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