It is perhaps not widely known that the use of iron as catalyst for cross coupling predates the use of nickel and palladium for this very purpose.\(^1\) Although palladium now definitely reigns over this field of utmost practical importance, the last decade has seen many attempts at reviving the early work on iron-catalyzed C–C bond formation, including efforts from my group.\(^3\) The possible advantages of supplanting palladium by cheap, well-accessible and largely benign base metals such as iron are obvious; a growing number of applications from industrial laboratories showcases the potential relevance. Importantly, this emerging field seems to marry legitimate utilitarian considerations with fundamental questions of great significance: Why is iron at all capable of mimicking the chemical behavior of a noble metal – at least in in certain cases – although its inherent (redox) chemistry is fundamentally different? Why do iron-catalyzed cross-coupling reactions not seem to follow a uniform mechanism? Which oxidation states are relevant and do changes in spin state affect catalyst turnover? If so, how can such processes be fostered by creative ligand design? Which analytical tools do we actually need to characterize the active species and follow their fate? Will iron allow substrates to be activated that do not qualify for palladium chemistry?

If one takes these largely open aspects of iron-catalyzed C–C bond formation as “pars pro toto”,\(^4\) the intellectual dimensions of the area of non-precious transition metal catalysis in general become apparent. It is safe to predict that this field of research greatly benefits from a firm interface with bioinorganic chemistry, since nature makes ingenious use of the redox abilities, Lewis acidity and coordination properties of iron, manganese, copper, zinc, vanadium, molybdenum, cobalt and others to accomplish transformations of breathtaking beauty and selectivity. Despite impressive advances in the understanding of nature’s design concepts, we are still far away from being able to emulate the profile of numerous metallo-enzyme catalysts, in particular when it comes to oxidation reactions or the activation of small and/or barely reactive molecules.

These few comments praising the opportunities for discovery and innovation provided by base-metal catalysts should by no means be mistaken for a plea against their noble cousins. On the contrary: the favorable characteristics of the noble metals will always pay valuable dividends and the scientific community is well advised to continue studying their chemical behavior in the greatest possible depth. Yet, I sincerely believe that the qualitative and quantitative growth rate in the base-metal arena is currently steeper, and early transition metal reagents and catalysts will almost certainly shape the future of advanced organic synthesis to an ever increasing extent. To assist this evolutionary process, I gladly accepted the invitation to co-sponsor this special issue of *Advanced Synthesis & Catalysis* with Prof. Christina White, who’s much admired expertise is complementary to my own. It is gratifying to see a collection of innovative contributions, which give the reader a flavor of the rapid progress in this vibrant and important field.
References


[4] *pars pro toto*=a part taken as representative for the whole.