Young Career Focus: Prof. Miłosz Pawlicki (Jagiellonian University, Kraków, Poland)

Background and Purpose. SYNFORM regularly meets young up-and-coming researchers who are performing exceptionally well in the arena of organic chemistry and related fields of research, in order to introduce them to the readership. This Young Career Focus presents Prof. Miłosz Pawlicki (Jagiellonian University, Kraków, Poland).

Biographical Sketch

Prof. M. Pawlicki

Miłosz Pawlicki studied chemistry at the University of Wrocław (Poland), eventually completing his M.Sc. degree in amino acid and peptide chemistry. At the same university, he completed his Ph.D. studies in 2004 with the mentorship of Prof. Lechoslaw Latos-Grażyński focusing on the synthesis of oxygen-containing porphyrinoids. Between 2007 and 2009 he was a Marie-Curie Fellow working as a post-doctoral researcher with Prof. Harry L. Anderson in Oxford, UK. In 2009 he returned to Poland and started his independent research path at the Department of Chemistry, University of Wrocław as an assistant professor and associate professor after gaining a D.Sc. degree in 2016. Now he is an associate professor at the Jagiellonian University (Poland, Kraków) where he focuses on the potential that is available in organic chromophores where the switching between aromatic and antiaromatic delocalisation is possible.

INTERVIEW

SYNFORM *What is the focus of your current research activity?*

Prof. M. Pawlicki Along with my collaborators I focus my research activity on several aspects of conjugation and delocalisation within unsaturated hydrocarbons. The delocalisation in strongly conjugated systems leads to aromatic or antiaromatic paths and that is what we are mostly interested in when designing and synthesising new structural motifs. We are mostly interested in deep changing of observed behaviour by introducing several modulators that can lead to control of the spectroscopic activity. Thus the modulation and control of delocalisation by switching between available options within one skeleton and based on fundamental modifications (redox, protonation–deprotonation) and covalent involvement of electron-deficient (boron) or electron-rich (nitrogen) elements remain central points of our work.

SYNFORM *When did you get interested in synthesis?*

Prof. M. Pawlicki I think it was during the second year of my undergraduate studies. I was flipping through an old textbook, Morrison & Boyd's Organic Chemistry (the first textbook translated to Polish), and I found the intriguing Kiliani–Fisher reaction that modifies carbohydrates. The elegance of elongation of a carbohydrate chain had a significant influence on my fascination with synthesis. And even though currently we do not work on carbohydrates, I really appreciate the reactivity of carbonyl functionality and the potential that this small functional group has. Actually, we are using the mentioned functionality in our current designs of skeletons for making further processes involving a C=O unit, like the McMurry coupling or Wittig reaction. It has a significant influence on our synthetic strategy for accessing the cyclic and strongly conjugated molecules we are looking for.

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SYNFORM *What do you think about the modern role and prospects of organic synthesis?*

Prof. M. Pawlicki In the current world we can actually define two major fields of applicability where the modern role of organic synthesis is easily noticeable. The first one is an industrial part where the knowledge of organic synthesis is important for day-to-day life as the newly synthesized molecules have shown an enormous influence on the progress made by the world in the last several decades. Without question, the industrial usage of organic synthesis would not be possible without the fundamental studies focused on establishing new methodologies that are creating additional roles for organic synthesis. The huge potential of new molecules that find their place in many fields would not be possible without organic synthesis that creates a solid basis for being very optimistic about the prospects of this field.

SYNFORM *Could you tell us more about your group's areas of research and your aims?*

Prof. M. Pawlicki The work we are conducting focuses on understanding the observed properties and correlating them with the structure, eventually deriving the expected behaviour from a carefully planned and designed skeleton. The important aspect of our research involves controlling the final outcome of our target molecule. We are focusing on several fundamental initiators (protonation/deprotonation and also redox modification) that modify the observed delocalisation paths and substantially change the final outcome. In our current research, an important role has been attached to triphyrin(2.1.1) (Figure 1) – a strongly conjugated structure that in addition creates a perfect environment for boron(III) (another crucial player in our projects). By merging together those elements we can modulate two fundamental aspects strongly linked with conjugated systems – the optical and magnetic responses. Both of those aspects actually have significant applicability potential with respect to modulation of absorbance/emission (*Chem. Commun.* **2015**, *51*, 11362–11365) or switching from aromatic to anatiaromatic paths (Figure 1, Part A; *Angew. Chem. Int. Ed.* **2014**, *53*, 2992–2996; *Angew. Chem. Int. Ed.* **2015**, *54*, 1906–1909) eventually stabilising diatropic and paratropic currents in one system at the same time (Figure 1, Part B; *Chem. Eur. J.* **2019**, *25*, 15477–15482). Following those general ideas, we have introduced several switchable structural motifs where the final behaviour can be modulated, thereby substantially changing the observed outcome. Importantly, those processes show reversibility which creates further possibilities for applications.

SYNFORM *What is your most important scientific achievement to date and why?*

Prof. M. Pawlicki I won't be extremely original if I say that I hope the biggest achievement is still to come. Nevertheless, I have several results on the list that bring a story to my mind.

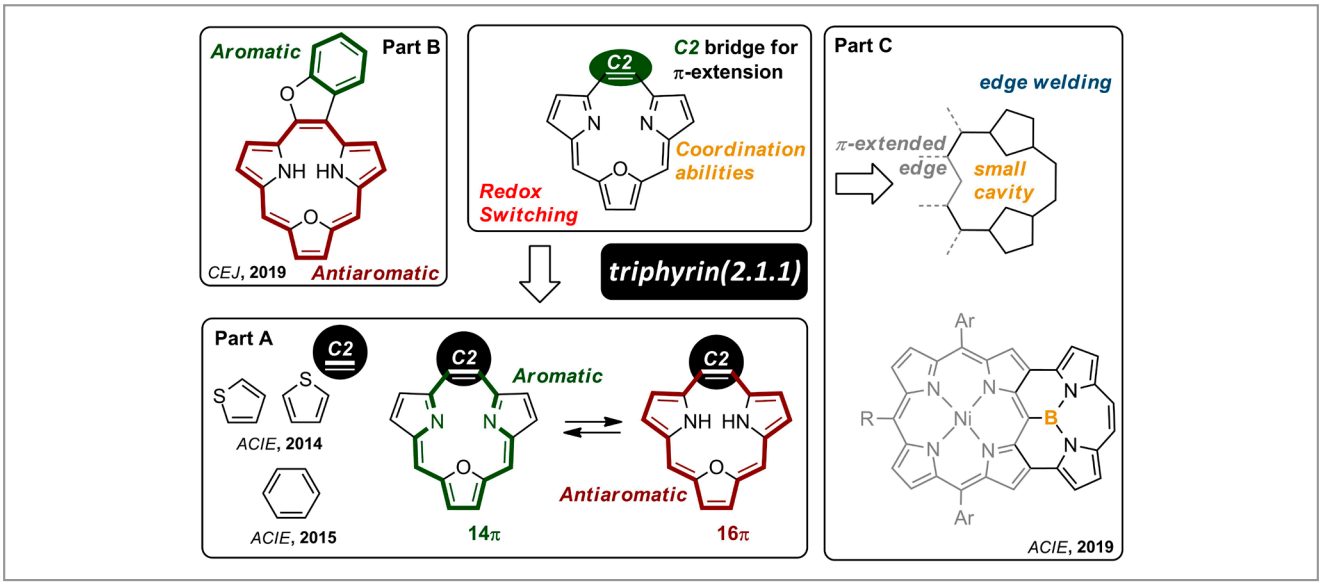

Figure 1 Classical way of reductive amination

It is typical that the newest work is the most important one but while looking on our hitherto designed systems I can see the evolution of the general idea of controlling the behaviour of designed skeletons. But the most important so far is a modulation of strongly conjugated skeleton with specific edge-welding with triphyrin(2.1.1) (Figure 1, Part C) that created a system with a changeable delocalization path (*Angew. Chem. Int. Ed.* **2019**, *58*, 10946–10950). The presented approach opens the potential for modulation of well-defined structures by a controlled 'defecting' and introduction of an electron-deficient element that in addition can be further changed via an axial coordination, thereby influencing overall behaviour.