Young Career Focus: Dr. Kevin Cariou (Chimie ParisTech, PSL University, CNRS, Institute of Chemistry for Life and Health Sciences, France)

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 Dr. Kevin Cariou (Chimie ParisTech, PSL University, CNRS, Institute of Chemistry for Life and Health Sciences, France).

Biographical Sketch

Dr. K. Cariou

Kevin Cariou graduated from Chimie ParisTech (France) in 2002 and received his PhD in 2006 from the University Pierre and Marie Curie (now Sorbonne University) in Paris (France) under the supervision of Prof. M. Malacria and L. Fensterbank, where he studied platinum- and gold-catalyzed transformations with a joint CNRS-Sanofi BDI fellowship. From 2007 to 2009, including one year as a Lavoisier fellowship holder, he worked as a postdoctoral researcher in the group of Prof. A. J. Frontier at the University of Rochester (NY, USA) in the field of total synthesis. He was appointed as a CNRS Researcher in 2009 at the Institut de Chimie des Substances Naturelles in Gif-sur-Yvette (France) in the group led by Dr. R. H. Dodd. He obtained his Habilitation à Diriger les Recherches (HDR) in 2015. From 2017 to 2019, he was group leader before moving to Chimie ParisTech in January 2020 to work with Prof. G. Gasser. In 2021 he was appointed CNRS Research Director. He was awarded a Thieme Chemistry Journals Award in 2022.

Kevin listens to a lot of music (often with loud guitars) and enjoys spending time outside, preferably near the ocean (if possible, in the waves), two passions he tries to share with his two kids.

INTERVIEW

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

Dr. K. Cariou My research lies at the interface of developing new synthetic methods and the development of biologically active molecules. In terms of methodology, we focus on iodine(III) reagents, ynamides and organometallic compounds to try to access original scaffolds. For medicinal chemistry, our interest mostly lies in the development of anti-infectious molecules.

SYNFORM *When did you get interested in synthesis?*

Dr. K. Cariou I know it sounds clichéd but as a very small kid, I already liked chemistry, probably without knowing it was actually chemistry. Both my parents are pharmacists and there were some chemicals in the garage. I vividly remember a small flask with a drop of mercury inside, heavy and metallic yet liquid; that was fascinating. I also remember permanganate crystals, which could transform clear water into a beautiful purple solution. (Note: parents, do not let your children play with chemicals without adequate supervision!).

I've always enjoyed chemistry during my studies, choosing it as a major as soon as I could. After high school, I realized that I enjoyed organic synthesis more than the other fields and decided to focus on it when I was accepted to Chimie ParisTech. It is a peculiar field, the joy of having made something that you once drew on a sheet of paper following a strategy that you devised is immense, but it also comes with a lot of failures and frustrations that have to be overcome. The Account recently published by my postdoc mentor, Prof. Alison Frontier, really showcases all the feelings that one might go through during a synthesis (*Acc. Chem. Res.* **2021**, *54*, 1817) and all the

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back-and-forth thinking that is needed to succeed despite numerous hardships.

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

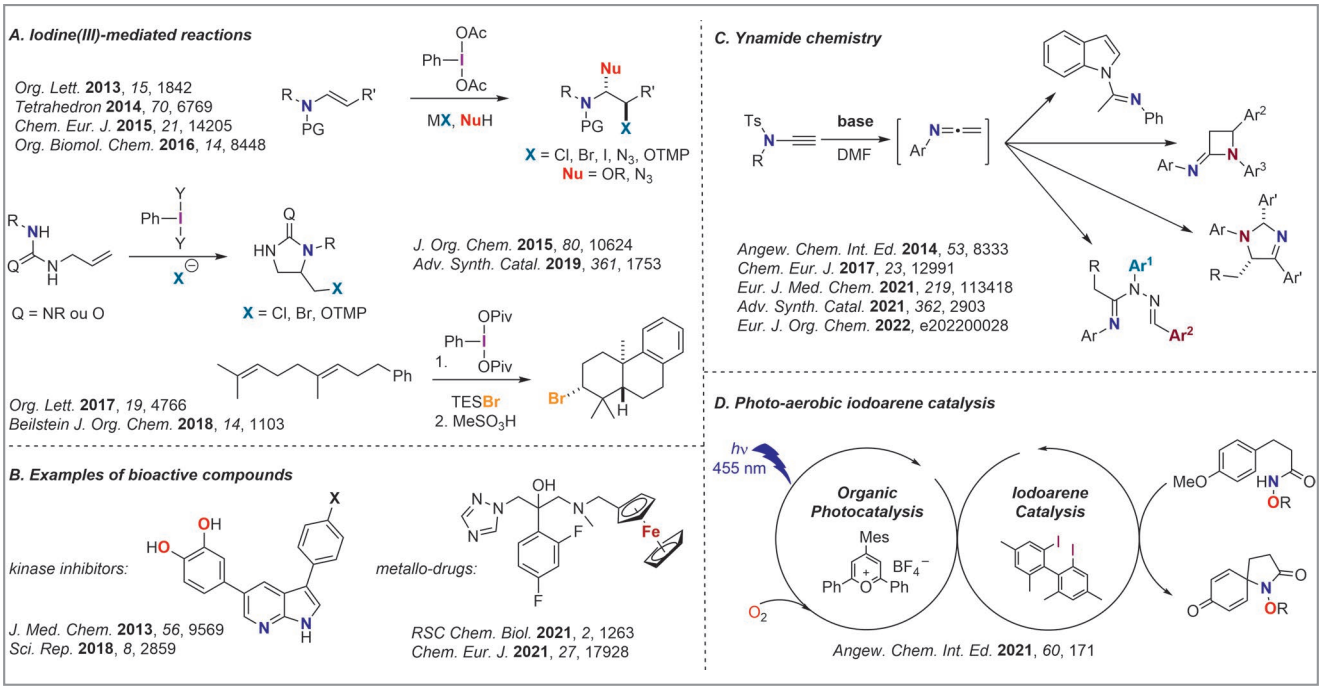
Dr. K. Cariou For a while, it seemed that organic chemistry was passé, an old discipline where the last important discoveries dated from the 1970s (the Mirozoki–Heck coupling for example) and everything done since was merely dusting up old reactions. I obviously beg to differ, as there have been tremendous accomplishments recently. These accomplishments are not just "we are able to do it faster in a more eco-compatible fashion" or 'trendy' as one might have considered CH-activation or photoredox catalysis at first sight. New reactivities have been uncovered, which enable access to uncharted synthetic routes and chemical space. I strongly believe that we need new reactions to make new molecules that will prove useful for medicinal purposes, energy storage or even information transfer. This is undoubtedly impossible without organic synthesis and organic chemists will have a key role to play to make unforeseen reactions tangible.

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

Dr. K. Cariou As I mentioned, we are interested in anti-infectious molecules. Research in the field of antibiotics and antifungals has been mostly left aside by industry, while resistances have become extremely worrisome. This led to the current situation where the WHO has issued a list of bacteria for which new antibiotics are urgently needed and will soon publish an analogous list for pathogenic fungi. This places the burden of risk on the shoulders of academics and fragile start-ups. Our goal is to use our knowledge and expertise in molecular synthesis to propose new options for treating resistant strains. The ideal aim is to both overcome resistances and avoid the apparition of new ones. For that we not only use the great toolbox of organic synthesis but, in the meantime, also strive to expand that toolbox.

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

Dr. K. Cariou I would say it is the aerobic idodoarene catalysis system that we recently developed using a catalytic photoredox mediator. When you work in the field of hypervalent



Scheme 1 Synthetic development using iodine(III) reagents (A) and ynamides (C), examples of original bioactive compounds developed (B) and dual catalysis concept (D) in the last 10 years.

iodine(III) chemistry you are bound to think about how to make it catalytic and a lot of people have brought clever solutions to that issue. I have had the idea of an aerobic iodoarene for a while, but it was (and still is) hard to convince funders of the validity of this concept. Even after the breakthrough made simultaneously by Powers (*Nat. Chem.* **2018**, *10*, 200) and Ochiai and Miyamoto (*Chem. Commun.* **2017**, *53*, 9781) in 2017, the idea to render this aerobic process photocatalytic seemed too crazy for funding. Eventually the CNRS granted me a one-year postdoctoral fellowship in 2019 and I was lucky to hire a talented young doctor (Loïc Habert). We were then able to validate the concept and publish our results (*Angew. Chem. Int. Ed.* **2021**, *60*, 171) in about a year. Although it is still imperfect, devising an artificial oxidative transformation in which the only stoichiometric reagents are dioxygen and photons felt like a real step forward. We got great feedback from the community and, on a very personal level, I would probably not be answering these questions without this study and Loïc's hard work.

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