Young Career Focus: Dr. Debasis Banerjee (Indian Institute of Technology Roorkee, India)

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. Debasis Banerjee (Indian Institute of Technology Roorkee, India).

Biographical Sketch

Dr. D. Banerjee

Debasis Banerjee grew up at Asansol (Hatinal), West Bengal, India. He graduated with an M.Sc. degree in organic chemistry from Banaras Hindu University and obtained his Ph.D. in organic chemistry from the Indian Institute of Technology Kanpur in 2011 under the supervision of Prof. M. L. N. Rao. Thereafter he moved to the Leibniz Institute for Catalysis (LIKAT) in Germany for a postdoctoral position with Prof. Matthias Beller (2011–2014) and subsequently held another postdoctoral position (2014–2015) at Stockholm University (Sweden) with Prof. Jan-Erling Bäckvall. In 2015, he accepted the position of Assistant Professor at the Indian Institute of Technology Roorkee (Uttarakhand, India). Currently he is an Associate Professor at the same institute from August 2020. His research interests include design and synthesis of non-precious-metal catalysts, enantioselective dual-catalysis, activation of small molecules, activation and functionalization of sp^3 C–H bond and heterogeneous catalysis for sustainable organic transformations. He is a recipient of the SERB-Early Career Research Award (2016), the DAE-Young Scientist Research Award (YSRA-2016) and the Evonik Call for Research Proposal (ECRP-2016) Award by Evonik Industries GMBH, Germany. He was recently selected for the Thieme Chemistry Journals Award 2020.

INTERVIEW

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

Dr. D. Banerjee My group's research is centered on the sustainable development using non-precious-metal catalysts (Fe, Ni or Mn) as the key for industrial applications. We focus on the efficient utilization of renewable raw materials, designing atom-efficient synthetic methods and avoiding the use of multi-step synthesis. I find it most exciting to design a synthesis route which eliminates stoichiometric waste production.

SYNFORM *When did you get interested in synthesis?*

Dr. D. Banerjee I developed an interest in organic chemistry in high school. Later on, during my bachelor's and master's studies, we were taught organic chemistry by excellent professors, which significantly enhanced my fascination with organic synthesis. Moreover, during the course of my doctoral and post-doctoral studies I got to know about various field of organic chemistry and learned incredible possibilities of research in the area of organic synthesis.

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

Dr. D. Banerjee A wide variety of chemical feedstocks and fuels are derived from fossil resources. Therefore, depletion of natural resources and fossil feedstocks has raised serious environmental concerns. Thus, there is a potential challenge to find alternative pathways to overcome such problems. One such alternative might be the use of renewable lignocellulosic materials for a sustainable future. However, the biggest synthetic challenge would be 'Waste to Wealth', namely to reuse and recycle our valuable resources following environmentally benign technology.

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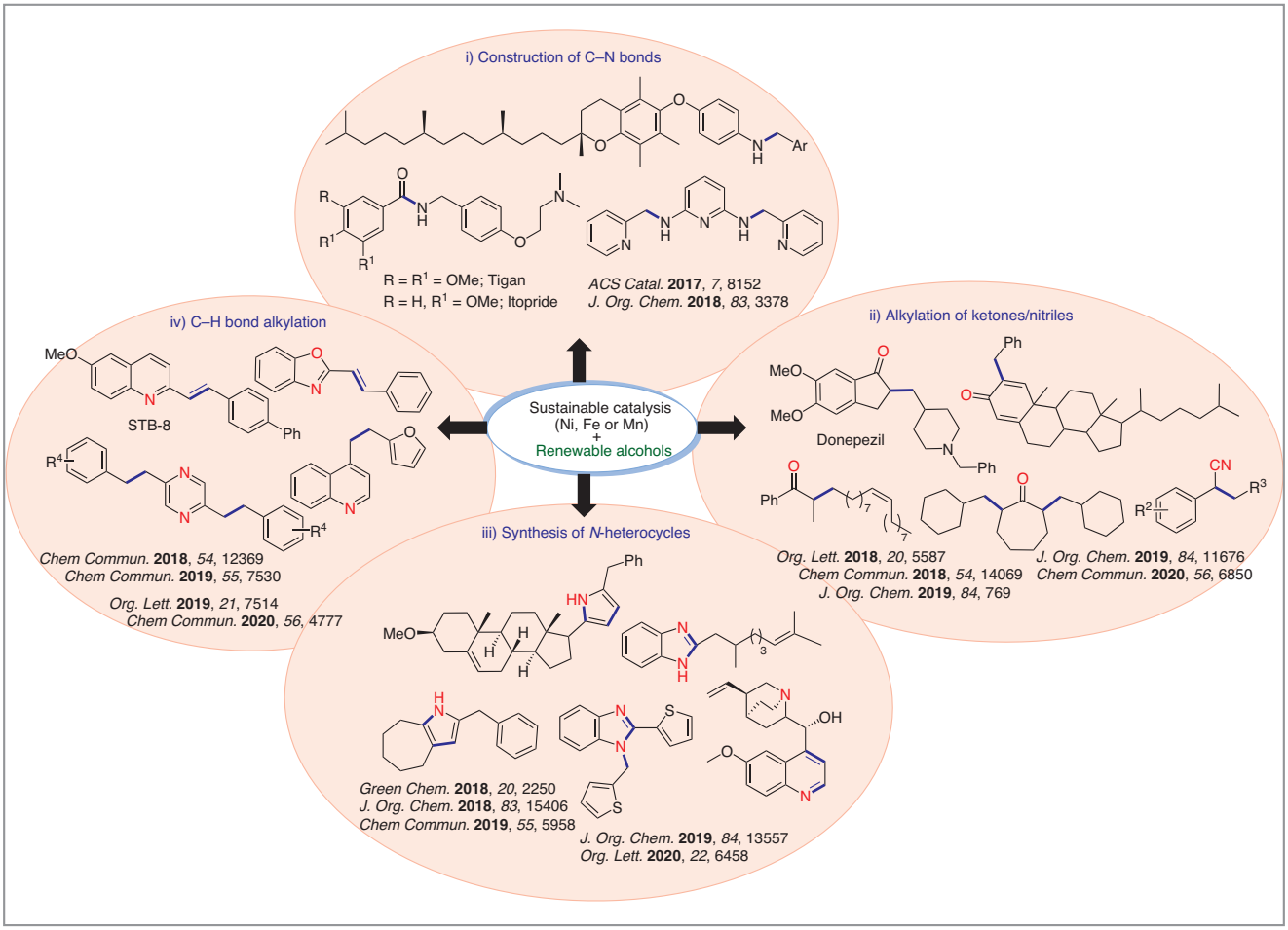
SYNFORM *Could you tell us more about your group's areas of research and your aims?*

Dr. D. Banerjee A recent trend in catalysis research is to replace precious-metal catalysts using non-precious transition metals of comparable efficiency. In this direction, we made an outstanding contribution in the homogeneous Ni-, Fe-, and Mn-based catalyst system following a hydrogen-auto-transfer principle. Presently, at IIT Roorkee, our research group independently developed several challenging catalytic problems based on nickel catalysis for sustainable organic transformations using biomass-derived and inexpensive renewable alcohols. For instance, we made an important contribution in the areas of amination, amidation, construction of *N*-heterocycles (pyrroles, pyridines, quinolines, indoles, quinoxalines, and benzimidazoles). All of these *N*-heterocycles are highly important motifs in pharmaceuticals and drugs. Thereafter, activation of the weak sp^3 C–H bond of 2-alkylheteroarenes with alcohols and functionalization of ketone enolates with alcohols were developed. In all these areas, our research group managed easily to contribute some original chemistry. Our goal is to develop environmentally benign technologies using earth-abundant-metal catalysts in combination with renewable resources (Scheme 1).

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

Dr. D. Banerjee One of our most important scientific achievements to date is the development of bifunctional nickel catalysis following a hydrogen-borrowing strategy. In general, nickel catalysts are known for hydrogenation reactions. Unfortunately, the bifunctional nature of the nickel catalysts was not well developed in earlier studies. It was believed that the



Scheme 1 Banerjee lab research overview

free hydroxy group of alcohols would retard nickel-catalyzed transformations owing to their strong binding affinity with nickel. In this context, for the first time we demonstrated the bifunctional nature of nickel catalysts involving hydrogen-borrowing approaches. Moreover, this study established a starting point in our group and we developed several interesting chemistries using nickel-based catalytic systems for the efficient and highly selective synthesis of amines, amides, and biologically interesting heterocycles using free alcohols, diols or amino alcohols (*ACS Catal.* **2017**, *7*, 8152–8158).

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