L11-Harnessing Innovation for a Sustainable Approach to Organic Synthesis

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As reported by J. A. Berson: "Science at the highest, most creative level is a bit like playing jazz. One has to be disciplined, yes, but also open, flexible, ready to abandon an idea and pick up a new one when it thrusts upon one."[1] Despite the multidisciplinary interactions involved in performing chemistry, most chemists are extremely conservative when designing their synthetic protocols.

E.J. Corey, Nobel Prize in 1990, highlighted the need to balance "two different research philosophies, one embodying the ideal of a deductive analysis based on known methodology and current theory, and the other emphasizing innovation and even speculation". Economic literature has often stated that innovation and evolution feed off the following triad: demand pull, science push and technology push. Present-day universities and research centres can be compared to the coal mines of the 19th century in that they are the real work-horses of a modern economy; bridging the gap between academia and industry with their research and production. If we are to achieve innovation in organic synthesis, the two main pillars, besides the understanding of reaction mechanisms and the design of eco-friendly strategies, must be efficient catalysis and process intensification with suitable enabling technologies and reactors.[2] Ultrasound, hydrodynamic cavitation, microwaves, ball milling, flow chemistry, and other non-conventional techniques can dramatically enhance chemical conversions as well as cutting down reaction times and energy consumption. Chemistry, and in particular organic synthesis, have often been criticized for their propensity to exacerbate both the depletion of natural resources and the rate of ecological impact. In the third millennium, it is now mandatory to harness innovation to forge a sustainable approach to organic synthesis. In fact, the demand for renewable energy sources for organic synthesis has steadily increased over the last two decades. Biomass has been recognized as a major worldwide, renewable source of fixed carbon and one which can be used for the production of fine chemicals, biochemicals, bio-based polymers and biofuels providing immense industrial and economical benefits in chemical production and beyond, thus ensuring the complete embedding of the circular economy's recycling concepts. All of these notions will be amalgamated across a small number of practical examples which will emphasise the fact that efficient, sustainable and scalable synthetic protocols now require a multidisciplinary approach.

References

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