GUEST EDITORIAL

Catalytic Asymmetric Synthesis

"The world is chiral and clinal, enjoy symmetry wherever you find it." — **Vladimir Prelog**

The chirality of the observable world provides inspiration and impetus for many domains of human endeavor. From the design of medieval spiral stairwells, to Alice's musings in *Through the Looking Glass*, to elucidating the origins of biomolecular homochirality, the handedness of both the macroscopic and molecular worlds is inexorably tied to our daily experience and our quest to understand Nature.

Today the echo of Pasteur's landmark revelation of the molecular origins of optical activity still resonates in the research activities of many scientists. But instead of rationalizing observable phenomena, chemists are now engaged in the design and synthesis of molecular substances that will display specific properties, activities, and functions. This is true throughout the chemical enterprise, and includes the synthesis of single-enantiomer pharmaceuticals, the generation of nonlinear optical devices, the control of polymer structure and properties, the study of nearly all biochemical processes, and the pursuit of understanding molecular recognition and self-replication. Insofar as all of these activities require access to chiral molecules in stereochemically defined form and high configurational purity, it is no wonder that asymmetric synthesis has taken on a central role as the enabling discipline that can provide the materials and methods for the manifold applications of chiral compounds.

Within the realm of asymmetric synthesis, catalysis holds a special appeal for both the practitioner and the user alike. The ability to produce large quantities of desired, enantiomerically pure compounds from simple feedstocks and relatively small quantities of enantioenriched catalysts has spectacular practical implications. Moreover, the molecular engineering of such processes represents a fascinating challenge whose successful solutions require a combination of synthetic prowess, mechanistic understanding, and chemical intuition.

The relative importance of catalysis within asymmetric synthesis is readily apparent from the primary and especially the secondary literature. If the first milestone in the evolution of the asymmetric synthesis literature was the appearance in 1968 of Morrison and Mosher's classic *Asymmetric Organic Reactions*, it is striking in retrospect that only a few pages were dedicated to the topic of asymmetric catalysis. The famous five-volume series, *Asymmetric Synthesis*, by Morrison, published in the mid-1980s, committed the last of its volumes to catalysis. The final installation of the edifice of organic chemical knowledge that is *Houben-Weyl*, published in 1996, is dedicated to *Stereoselective Synthesis*, with substantial emphasis on catalytic methods. The appearance of the three-volume *Comprehensive Asymmetric Catalysis* in 1999 marks the latest milestone in the evolution of asymmetric synthesis as a chronicle of the impact of catalysis on organic synthesis.

It is remarkable that asymmetric catalysis, a field that saw its inception over 30 years ago, still continues to define one of the frontiers of research in organic chemistry. Given the extraordinary advances made over the past decade in particular, we felt it would be most appropriate to assemble a special issue dedicated to some of the field's most important, recent developments. In that quest, we have asked several of the leading investigators of asymmetric catalysis to provide accounts of their most significant contributions. Through their eyes we see the enormous diversity of activities in catalyst design and process engineering that draws from all corners of the periodic table in transition metal, main group, and lanthanide chemistry. The result is a rich and multifaceted celebration of the excitement of reaction invention, discovery, and development.

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