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Molecular Catalysis: Science and Opportunities

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Chemists are proud of their ability to create highly valuable compounds from inexpensive materials. Our health and daily life rely largely on man-made substances produced by multi-step chemical conversions of petroleum- or biomass-based feedstocks. However, the current standards of chemical synthesis need to be much improved. Many existing chemical processes, though beneficial, produce unwanted wastes along with target products, and inefficient recovery of solvents is an environmental problem. Every reaction should proceed with a high atom-economy, and the overall synthesis must be accomplished with a low E-factor, thereby minimizing the cost of waste disposal. Without such approaches, chemical manufacture is unsustainable in the 21st century. Molecular catalysis plays a key role in achieving this goal. Our research efforts along this line will be discussed.