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The quest for stereochemical control in organic synthesis: From concept to practice

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The present-day level of achievements in organic synthesis methodology in general, and natural products in particular, is the highest ever compared to as recently as a decade ago. Natural products varying in their structures and biological activities continue to provide synthetic chemists with the incentives to initiate, and the perseverance to pursue challenging research programs. This has also led to the development of innovative methods toward efficient and highly stereocontrolled bond-forming reactions. Stereochemical control in the synthesis of biologically relevant molecules and drug prototypes is a primordial factor in ensuring productive interactions with target enzymes, receptors and other macromolecules. When presented with the structure of a target molecule to synthesize, our first contact is visual. What follows is a subliminal interplay between the eye and the mind's eye, triggering a complex, yet quasi-instantaneous series of visual relational and visual reflexive chemical thought processing events that are a part of the psychobiological basis of generating a synthesis plan. Adding the third dimension imposed by the stereogenic nature of carbon atoms embedded in architecturally complex molecules heightens the challenge of execution in the laboratory. The heuristic aspects of visual and mental thinking paradigms relating to stereochemical issues will be discussed in the context of viable synthetic strategies toward biologically relevant molecules.

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Second-order optical nonlinearity dominated by molecular configuration and crystal packing structure for organic optical device design

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Nonlinear optical organic devices have high potential for compact and high power green and blue laser and high speed optical switching. Especially, nonlinearity in organic crystal is larger than one in inorganic crystal. On the other hand, organic crystal is molecules crystal and the nonlinearity of crystal depend on nonlinearity of molecules, its surrounding and its packing condition. Generally, the molecules with the appropriate donor-acceptor pair exhibit the large second-order optical nonlinearities. However, these molecules tend to form centrosymmetrical structures in crystallization because of their dipole-dipole interaction. We could get P1 symmetry crystal by introducing chirality. The crystal size is not large and minimum sized to evaluate optical properties. J. Zyss et al reported crystal's nonlinearity based on oriented gas model of organic molecules crystal. However, its model is lacking in treatment of space group P1 symmetry. In the case of P1 symmetry, d11 is thought to be largest nonlinear optical coefficient and it is difficult to get phase matching SHG. Nonlinear optical properties on the P1 symmetry crystal was investigated by using oriented gas model, theoretically and experimentally. D11 is largest coefficient, but P1 crystal enable to get large phase matching SHG.

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