MEETING REPORT

Weak interactions in chemistry*

From the days of alchemists, the primary goal of chemistry has been understanding the behaviour of molecules and their construction from the constituent atoms. In recent years, chemists have extended their goal beyond the atomic and molecular chemistry into the realm of supramolecular chemistry controlled mainly by weak interactions. These interactions include hydrogen bonding, van der Waals force, hydrophobic effect and π–π stacking leading to new structural motifs like molecular self-assembly, mechanically interlocked molecular architectures, host–guest complexes, etc. The role of weak interactions in biology too is almost ubiquitous; the cooperative weak, noncovalent forces crucially dominate the structure of the DNA double helix or globular protein forms. The origin of these weak interactions in chemistry is related either to the electron correlation or to the long-range electronic interactions. On the other hand, the field of weak interactions in physics is mainly governed by the exchange of W or Z bosons and is responsible for the weird and wonderful phenomenon known as parity violation. The parity violation effect has far-reaching consequences both in atomic and molecular sciences. Thus, the field of weak interactions has many faces, and demands a meticulous exploration of the subject both from the experimental and theoretical viewpoints.

The scope and purpose of the international symposium on facets of weak interactions in chemistry was to provide a platform for discussing the rapidly progressing interdisciplinary field of weak interactions and to uncover new research directions. The symposium brought together experts from a diverse background in chemistry, physics, biology and materials science. In addition to the inaugural and three plenary lectures, there were 14 invited lectures and 87 poster presentations. P. Balaram (Indian Institute of Science (IISc), Bangalore) gave the inaugural lecture on 'Recruiting nonbonded interactions and hydrogen bonds in the design of folded peptides'. A plenary talk on 'Designing still matters to crystal engineering' was delivered by Mike Zaworotko (University of South Florida, USA). Gautam Desiraju (IISc) talked on 'Recent results on hydrogen bonding in molecular crystals'. Debashis Mukherjee (Indian Association for the Cultivation of Science, Kolkata) gave a plenary talk on 'Probing fundamental weak interactions with atoms and molecules: the burgeoning field of non-accelerator based particle physics'. The meeting provided an excellent opportunity for the young researchers to present their latest research and to participate in the extensive discussions.

Self-assembly being an important aspect of weak interactions allows the construction of advanced molecular or supramolecular systems from small building blocks. Host–guest recognition, for its self-selectivity, environmental responsiveness and convenient application to complex molecular devices play a significant role in self-assembled systems. During this process, the association constant between the host and guest is an important standard to identify the properties of the systems. To prepare mechanically interlocked structures and large supramolecular systems efficiently from small molecules based on a host–guest recognition motif, it is necessary to increase host–guest association constants. In this symposium, there were many lectures on such self-assemblies.

Discussion on the understanding of interactions that bring molecules together took place. The idea of guest-responsive inclusion host compounds was discussed based on strongly directional synthons and motifs. In addition, the gradual change of crystal engineering from design to properties was focused upon. An emphasis was placed upon illustrating why design still plays an important role in crystal engineering and why weaker forces are key to reaching the next level of control over both structure and properties.

*A report on the International Symposium on 'Facets of Weak Interactions in Chemistry (Celebrating the International Year of Chemistry and 150th Birth Anniversary of Acharya Prafulla Chandra Ray)', held during 13–15 January 2011 at the Saha Institute of Nuclear Physics Auditorium Complex, Kolkata. It was organized by the Department of Chemistry, University of Calcutta.

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