

Field: Chemistry/Biochemistry

Planning Group Members:

***Günther Knör, Institute of Inorganic Chemistry, University of Erlangen-Nuremberg
Takehiko Wada, Graduate School of Engineering, Osaka University***

Session Topic:

Modeling and Control of Biomolecular Functions

Over millions of years under evolutionary pressure nature has optimized the design and efficiency of its functional devices. Inspired by the way in which building blocks and materials are arranged in living systems, chemists become more and more successful in imitating certain aspects of biological functions with synthetic model compounds. An important driving force in this context has been the enormous progress in elucidating the details of biomolecular structures at atomic resolution during the last decades.

Our knowledge about the mechanistic key-steps of some of the most fascinating chemical processes on earth including photosynthesis and the elegant catalytic reactions performed by natural enzymes is constantly increasing. Future efforts at the frontier of biomimetic chemistry may now be targeting the exploitation of alternative energy sources and the development of efficient catalysts to drive controlled chemical processes under mild and environmentally benign reaction conditions. The enormous potential of bio-inspired chemistry can contribute to critical human needs and certainly deserves an increasing attention throughout the scientific community.

Moreover, the completion of the human genome sequencing project has recently provided crucial biochemical information with a profound impact on biological and biomedical research. Current developments not only include pharmacogenomic and pharmacogenetic technology, as well as gene therapeutic drugs using antisense and antigene strategies, but also functional nucleic acids, such as DNA/RNA aptomers, Ribozymes, DNazymes or siRNA. Although we have acquired a certain degree of knowledge about the primary sequence of essential exons and promoter regions of DNA, we are still just at the beginning in terms of understanding the relationship between the structure and function of nucleic acids.

Chemical synthesis and modification of DNA/RNA is the fundamental technology that has led to the molecular biology revolution. In the research field of bio-related chemistry in the post-genome sequencing project era, not only studies on the role of biomolecules in organisms, but also realizing their in cell chemistry becomes very attractive. Hence, the chemistry of DNA, RNA and nucleic acids not only *in vitro* but also *in vivo* is expected to open a new generational stage of bioorganic chemistry and molecular biology in the near future. Thus, if we can more fully comprehend the relationships between the structure and function of biomolecules, we should be able to design powerful synthetic tools for tailor made biomolecular functions in cells. Therefore, the completion of the human genome sequencing project is just a starting-point of a more sophisticated bioorganic chemistry of nucleic acids. Frontier researchers not only in biochemistry and chemistry but also in many related fields are now exciting the innovating science in cells and biomolecules. We absolutely consider that the various topics and future aspects of this session will be extremely attractive and satisfying for all the audiences in the 1st JGFoS Symposium .