GUEST EDITORIAL (by Prof Anil K. Singh)

Photochemistry is a branch of chemistry that deals with chemical, physical, and biological effects of UV, VIS, or IR radiation on molecules and materials. The action of solar light on chemicals and living systems has long been perceived as an essential element in all that exists on Earth ("**नूनं जनाः सूर्येण प्रसूताः।** All that exists was born from the Sun – *Brhad-devata*). Consequently, understanding the nature of interaction between light and matter and the ensuing chemical/ physical processes has been the object of great interest to researchers. While efforts of the early researchers led to the rationalization of several key issues and establishment of photochemistry as a fundamental science, the past few decades have witnessed a huge expansion in terms of concepts and tools in the field of photochemistry. Today, photochemistry has changed to large extent and the research and education in photochemical sciences have advanced rapidly. It has also significantly impacted many other areas of science and technology and led to development of several useful technologies.

The effect of light on organic compounds and on the living organisms has attracted attention since early days. While a scientific understanding of a number of organic photochemical reactions was developed earlier, the mid-20th century witnessed a kind of renaissance in organic photochemistry when some very fundamental developments were made with respect to structure and dynamics of electronically excited states of chromophoric groups present in organic compounds. It became possible to effect several organic reactions by photochemical means, and further use these reactions in the synthesis of useful compounds, which could not be synthesized otherwise. Photochemical studies of organic compounds have also significantly contributed in developing molecular understanding of many light-mediated important biological, medical and opto-electronic processes. With variety of remarkably diverse applications in many sectors such as materials science, agriculture, health science, pharmaceutical and chemical industry, chemical biology and many others, organic photochemistry has become a truly a pervasive science.

This issue on 'Light-Induced Chemistry of Organic- and Bio-molecules' demonstrates this pervasiveness of photochemistry. Articles drawn from different types of academic and research institutions including Universities, Colleges, IITs, IISERs, Research Institutes, etc. are included in this special issue. The articles in this issue pertain to a wide range of topics including the study of hitherto underexplored organic photochemical reactions, photophysical characterizations and studies in host-guest systems, spectroscopic and theoretical studies, photon-powered intelligent sensors and diagnostic molecular tools and technologies, photochromic materials for organic electronics, OLEDs, biochemical and biomedical applications of photochemical and photophysical processes, biomolecular imaging, controlled and selective drug transport, tracking and release, photodynamic therapy and chemotherapy, etc. All of these are important areas of research today and are the object of concern to many around the world. In the following is given an overview of these articles.

1. Mishra and Ali of the Department of Chemistry, Banaras Hindu University in their article titled "Imidazole and oxazole containing fluorescent dyad: Cu^{2+} induced fluorescence quenching and cyanide sensing *"On-Off-On" via* copper displacement approach" describe design strategy for imidazole and oxazole containing fluorescent dyad and further demonstrate its application for Cu^{2+} and cyanide sensing *via* displacement approach and fluorescence *On-Off-On* mechanism with rapid response in either of two sequential sensing events. Utilizing the concepts thus developed, they have also constructed a sequential molecular logic circuit.

2. VJ Rao and co-workers of CSIR-Indian Institute of Chemical Technology, Hyderabad and the Networking Institute for Solar Energy, New Delhi in their article titled "Delayed fluorescence based phenanthroimidazoles as OLED emitters having electron transporting properties" report design of new phenanthroimidazole compounds as materials for Organic Light Emitting Diodes (OLED). The electrochemical properties together with optical properties and in particular delayed fluorescence behaviour make these compounds potential electron transporting cum blue emitting materials for OLEDs, and provide leads for designing new compounds with improved properties.

3. J Mohanty and her colleagues of Bhabha Atomic Research Centre, Mumbai present a review of *p*H-responsive supramolecular assemblies of Hoechst-33258 with cucurbiturils: Modulation in the photophysical properties and show the efficacy of stimuli-responsive molecular host/guest supramolecular systems as interesting transporting and releasing tools. They have reported construction of a supramolecular system consisting of macrocyclic host such as cucurbit[7]uril (CB7) / cucurbit[8]uril (CB8) and biologically important dye Hoechst-33258 (H33258) as guest, capable of exhibiting *p*H-dependent structural orientation of the host after complexation and consequent

variations of fluorescent emission. Such fluorescent emission properties can find applications in biomolecular imaging and exchange of included guests for selective drug transport/release.

4. P Purkayastha of Indian Institute of Science Education & Research, Kolkata in this perspective article titled "Photophysical modulations of biologically potent small molecules in biocompatible microheterogeneous environments created by cyclodextrins and lipid vesicles" summarises recent progress in host-guest chemistry in biologically potent environment. Such photophysical concepts and methods can find interesting applications in chemical biology.

5. P Das and his co-workers of Indian Institute of Technology Patna in their article titled "Carbon dots (CDs) as a nanotool for integrated photodynamic therapy and chemotherapy" discuss the subject of photomedicine, wherein they have judiciously employed nanoscience and fluorescence techniques. CDs endowed with three responsibilities in the nanosystem: a donor for Protoporphyrin IX (Pp IX), a site for adsorption of chemotherapeutic drug Doxorubicin (Dox) and a fluorescent entity that could be tracked through imaging are found to be very useful nano-platforms for facilitating the delivery of two distinct drugs, a photosensitizer (PS) and the chemotherapeutic drug Dox. The CD-PS-Dox nanoassembly simultaneously offers tracking due to the inherent fluorescence of the individual participants of the nanoassembly.

6. M Pattabiraman of University of Nebraska, Kearney and V Ramalingam of Union College, New York, USA in their article titled "Supramolecular assistance of [2+2] photocycloaddition for cross-photodimerization" present an aspect of [2+2] photocycloaddition (PCA) reactions, which has been hitherto grossly under-explored. While the vast majority of the reports on [2+2] PCA are focused on the reaction between identical alkenes, the authors focus on PCA between non-identical alkenes and complie the reports on cross-dimerization reactions effected through supramolecular methods. These methods can be broadly classified based on two broad approaches: (a) crystal-engineering or (b) templation in solution or slurry. Both methods are based on the utilization of favorable intermolecular interaction between non-identical alkenes, and the use of a templating agent that promotes hetero-alkene arrangement in the ground state, which, upon photoexcitation yield the cross-dimer selectively.

7. B Datta and his colleagues of Biological Engineering and Chemistry Department, Indian Institute of Technology Gandhinagar in their article titled "Dimeric carbocyanine dye and nucleic acid aptamer mediated detection of food borne toxin" present new directions for the detection of food borne toxins. This fluorescence based technique can be useful in the advancement and operation of the food industry with respect to food processing and distribution. Their technique relies on non-covalent association of dimeric carbocyanine dye with the quadruplex secondary structures formed by aptamers specific for certain toxins. The presence of Bisphenol A (a specific toxin) in the solution leads to displacement of the dye that manifests as a loss of fluorescence.

8. R B Toche and his group from DB ASC College Peth, and KSW ASC College, Nashik in their article titled "Synthesis and photophysical properties of pyrrolo[3,2-*c*][1,6] naphthyridin-11(10*H*)-one derivatives", describe convenient ways of constructing these pyrrrolo-pyridine based heterocyclic compounds, which show high thermal stablity and interesting fluorescent emission properties. The photophysical studies indicate that these compounds can be useful in developing good light emitters.

9. A M Pettiwala and P K Singh of Radiation and Photochemistry Division of Bhabha Atomic Research Centre, Mumbai have reviewed recent developments in designing fluorimetric and colorimetric sensors, for detection of basic amino acids in their article titled "Recent developments in designing optical sensors for detection of basic amino acids". As the amino acids are key mediators in regulating human health, metabolism, and nutrition, an active research in developing sensor systems that offer a simple and rapid detection of amino acids is highly desirable. While briefly highlighting the recently devised ratiometric sensors for detection of basic amino acids, the authors have successfully attempted to provide a comprehensive overview of the developments in the sensing of basic amino acids.

10. P K Hota and his group of HNB Garhwal Central University, Srinagar in their article titled "Excited state and fluorescence probe properties of donor-acceptor substituted ethenes: A plausible photochromic material for

organic electronics" discuss the importance of excited state charge transfer processes and fluorescence probe properties of a few donor-acceptor substituted ethenes. It has been now known for almost two decades that the photochemistry and photophysics of conjugated linear polyenes are significantly influenced by the substituent and medium polarity. Such linear polyenes are capable of exhibiting solvent polarity dependent dual fluorescent emission, conformationally relaxed intramolecular charge transfer, and also aggregation-induced enhanced fluorescence in the solid state. The unique fluorescent emission properties of these rather simple organic compounds render them as novel extrinsic fluorescence probes for studying the microenvironment of proteins and other biological systems. The wide range of optical properties observed for these compounds provide new direction for the design and development of fluorescent probes for biological application, and also for materials in opto-electronic applications. The work described in this article also provides good leads for the design of next generation of linear conjugated ployenes as intelligent, functional opto-electronic materials.

11. J Sankar and coworkers of Indian Institute of Science Education & Research, Bhopal in their article titled "Bay- and *ortho*- ring annulated perylenediimides: Synthesis and their panchromatic absorption", examine photophysical properties of semi-coronenediimide (sCDI) and N-caprolactampyrrolo-perylenediimide (pPDI). The authors have synthesized sCDI and pPDI using DBU, wherein the reaction involves *in situ* removal of trimethylsilyl group followed by a ring formation at the *ortho* and bay positions of perylenediimide (PDI). Both the molecules exhibit diverse photophysical properties. pPDI demonstrates panchromatic absorption with quenched fluorescence while sCDI displays blue-shifted absorption with high fluorescence quantum yield.

The articles have good depth and breadth of scientific content and applicability of the concepts. A number of new advancements and applicabilities are discussed. The articles are expected to sensitize and promote new thinking in academic and industrial sectors with interest in light-mediated products and processes. Also, the topics presented in these articles serve as valuable references for further research in the area. Further, these discussions would go long way in motivating researchers to take up not only the conspicuous though presently challenging issues, but also to venturing into inconspicuous, uncharted domains of light-induced chemistry of organic- and biomolecular systems.

It is also noteworthy that organic photochemistry has undergone a greater change and has stimulated wide range of interest than probably any other area of organic chemistry. It remains at the forefront of research in diverse areas. As new methods are developed to probe into the details of excited state structure and dynamics in shorter time scales, the investigations into mechanistic aspects of organic photochemistry are expected to progressing at an accelerated pace for both existing and newer photoreactions. A dramatic increase in the near future in the synthetic and industrial uses of organic photochemistry is likely to grow at a much faster pace. It is also expected that environmentally benign and sustainable photo-processes as synthetic tools for the industrial production of chemicals, photochemical studies of organic compounds that are released in to the atmosphere/troposphere, light-mediated absolute asymmetric synthesis, dual wavelength asymmetric photochemical synthesis, solid state photochemistry, design and development of two-photo absorption compounds for medical and optical applications, design of intelligent and efficient photo-responsive biomolecular systems useful in understanding the dynamics of biological processes and phenomenon, photoswitches, phototriggers, photoactuators as tools to study dynamic biological processes, etc. will become the object of increasing interest of the organic photochemists. As it is not possible to cover in entirety all the aspects of photochemical studies of organic and biomolecular systems in one special issue, I am hopeful that IJC-B would continue bringing out additional special issues so that many other new developments in photochemistry of organic and bimolecular systems can be covered. In fact, with the kind of advancements made in recent years, it can be safely said that the frontiers of light-induced chemistry of organic- and bio-molecules would continue to grow with greater pace in the coming years than ever before.

Finally, I express my gratitude to the authors, reviewers and the IJC-B team for their support to this special issue. Special thanks to Dr N. Majumdar, Editor, IJC-B for his unstinted support in publishing this issue. He deserves all encomiums for his praiseworthy efforts in running the Journal over the years. Further, this issue would not have seen the light of the day without the efforts of Dr. S. Kanvah of IIT Gandhinagar. His contribution in bringing out this issue is commendable and he deserves hearty appreciation. I wish all of them continued success of their future research endeavours and fulfillment of their cherished ideals and goals.

January 22, 2018 Prof. Anil K. Singh