Radiation Chemistry at Cross Roads

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The invitation to write a brief note on my memoirs came at a challenging time in the existence of radiation chemistry. My journey in radiation chemistry research began at the Savitribai Phule Pune University (SPPU, formerly University of Pune) as a doctoral student in late sixties by investigating the effects of steady state radiolysis of inorganic oxyanions containing a halogen as the central atom in parallel to hot atom chemical studies. This was followed by post-doctoral research at Manchester University where I used the LINAC at the Christie Hospital, Paterson Laboratory to work on pulse radiolysis of alkali halides.

In retrospect, the two decade phase beginning from mid eighties has been the most rewarding professionally. My collaborations with Jai Mittal and the Late Clemens von Sonntag have been highly productive and fruitful. This collaborative research involved the use of both steady state and pulse radiolysis techniques in combination with quantum chemical calculations in a variety of biologically important molecules. The wealth of experience gained from these collaborations eventually resulted in my co-editing two books (Recent Trends in Radiation Chemistry, J. F. Wishart and B. S. M. Rao, World Scientific, Singapore 2010 and Radiation Chemistry: Present Status and Future Trends, C. D. Jonah and B. S. M. Rao, Elsevier, Amsterdam, Netherlands, 2001). Another significant achievement was the establishment of a 7-MeV LINAC facility, NCFRR at the SPPU with the support of the Department of Atomic Energy, India.

Let me now revert to my perspective on the present status and future trends in radiation chemistry. One could broadly divide the research in radiation chemistry into three phases: During the first phase radiation effects were studied using the natural and artificially made radioactive sources. A quantum leap in radiation chemistry research took place in the second phase with the advent of the pulse radiolysis technique. This phase contributed extensively to the basic understanding of the mechanisms of free radical reactions involving both reducing and oxidizing radicals together in chemical and biological systems. The accurate determination of rate constants of a variety of aqueous reactive species with precise knowledge of their yields made radiation chemical methods attractive. Thus, radiation chemistry has evolved as a mature field of study to address chemical, physical and biological problems.

The present phase, mainly during the last decade, has seen the development of laser driven ultrafast electron accelerators in pico and femto second time scales which are used to investigate fundamental processes in real time. The Japanese researchers have contributed significantly to this development. It is heartening to see the attempts by the Osaka group to extend this to otto second time region. In the 21st century, radiation chemistry is standing at a threshold where it could have easily lost its relevance to the challenges of modern technologies but instead has displayed its resilience. It is evident that it has managed to sustain and create a niche in today's upcoming technologies. I am optimistic that it will continue to evolve and contribute towards future technologies. In my opinion, the term “Radiation chemistry” appears to be slightly misleading suggesting exclusiveness to chemistry related research. Thus branding it as “Radiation processes in biological, chemical and physical systems” is a more appropriate term providing it futuristic impetus. This is evident from the scope of several symposia held in recent years. It is my firm belief that this impetus will come from Asia particularly the resilient Japan.

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