

Preface



Chronobiology is an interdisciplinary field of science that involves learning how living organism adapt to the changes imposed upon them by the movement of the earth on its axis and around the Sun. To adapt to these daily and seasonal environmental cycles, most life forms investigated thus far, have evolved with ‘time-keeping’ network called circadian (=daily) and circannual (= yearly) clock systems. Circadian clocks, constituted by transcription–translational autoregulatory feedback loops of several genes, mediate synchronization of the physiological and behavioural activities in organisms with the environmental cues, so they perform their best level over a 24-hour span. Similarly, circannual clocks, although their molecular gears remain largely unidentified, mediate synchronization

of the physiological and behavioural activities with the seasons of the year. Chronobiology is thus a quantitative study of rhythmic temporal relationships in biological phenomena across the day, the seasons or the year

A functional biological clock at the organization level conforms to a hierarchical system. This appears advantageous by offering multiple opportunities for the control—at the molecular level in the cell, at the mechanistic level within the time generating tissue, and at the level of synchronization of rhythms between peripheral (e.g. heart, liver, gut) and central (e.g. suprachiasmatic nucleus, pineal and eyes) clock tissues. However, layers of regulators can heighten the chances for dysfunction too; a disruption at any level can have forward and feedback effects on the clock circuitry. Intensive researches in the last few decades have churned out barrage of discoveries associating several chronic disorders and life style related diseases to the disruption of the clock-networks. The ever-growing list of diseases includes obesity, diabetes, depression and cancer.

Thus, the coordinated regulation of daily and seasonal events is crucial for optimal health. Mismatches may be catastrophic for the organism’s survival and impair reproductive fitness. Therein lies the importance of chronobiology as an integral part of our entire physiology. Connection between clock genes and obesity was discovered serendipitously using genetically modified mice several years ago. Rotating night shift work disrupts circadian rhythms and has been associated with obesity, metabolic syndrome, and glucose dysregulation. Further, an association between rotating shift work and type-2 diabetes (T2D) among female nurses in a long term study revealed a graded association between the duration of working life the nurses had been engaged in shift work and risk of developing type-2 diabetes. The role of the circadian rhythm system in major depression disorder has also been identified. Evidence from both animal and human suggest increase in cancer risks after disruption of circadian rhythms. For example, night shift work which disrupts melatonin production and circadian rhythms, increases risk of disease, especially breast cancer. Apart from association of the circadian rhythms to diseases, the timing and duration of therapy, known as Chronotherapy, is crucial in determining the efficacy of drugs in treating a diseases since several drugs are designed to kill cells at different stages of the cell cycle. In ovarian cancer, giving drugs early in the morning is found to be less toxic.

With growing evidence of chronobiology encompassing medical and other research fields including neuroscience, endocrinology, geriatrics, sports medicine and occupational medicine, the challenge to understand the processes of ‘biological time-keeping’ machinery or circadian rhythm remains enormous. The developed world, especially the labs in USA and Europe has progressed at a massive pace in the last decade and half in understanding the complex neuronal processes involved in all areas of chronobiology including the mammalian and human systems. However,

India has been left behind because of the lack of thrust and awareness in chronobiology and its clinical implications. Though chronobiological research centers exist in India, the interest remains mostly academic. Hence, organizing an International Congress on Chronobiology (ICC-2012) in New Delhi, India, was not an option but a necessity. ICC-2012 (3–7 October 2012) allowed pioneers from around the world to share their experiences, vision and the latest discoveries in the area of chronobiology with the Indian faculties, students and science administrators. Thus, ICC-2012 not only served as a catalyst to promote the fundamental and clinical research but also has been able to spread much needed awareness in this field of research among the science policy makers in India.

The articles included in the present special issue of Chronobiology reflect some of the areas that were covered in the ICC 2012, with greater emphasis placed on work emanating from Indian laboratories. This is first such an endeavour in this important field of Science in the country, for which I am grateful to the Director, CSIR-NISCAIR, New Delhi and Mr. Rajiv Mathur, Editor, *Indian Journal of Experimental Biology* who accepted my proposal to bring out a special volume on Chronobiology, and rendered all possible help throughout this endeavour. I would like to thank all those who contributed to the success of the ICC-2012, contributors to the present special volume on Chronobiology and reviewers, who evaluated the manuscripts. I hope this volume to be read by wide section of Scientists in India and abroad, and generate more interest in the field especially among Indian Scientists.

Prof. Vinod Kumar
Guest Editor
Department of Zoology
University of Delhi
Delhi 110 007, India
Mobile: +919818875429
E-mail: drvkumar11@yahoo.com