Foreword

Medicine, with the growth of laboratory sciences and technological development, has matured as a scientific discipline and metamorphosed from an art of healing and social science to 'biomedical science'. Application of biological science in the search for logical explanations of ill health has led to the re-characterization of illnesses in terms of their causes, coherent explanations of disease mechanisms as well as discovering rational ways to manage sickness.

We have, for this compilation, selected six themes which hopefully will represent the transitions and the rich possibilities that medicine has in the future. The emphasis is on conceptual advances in the ways of studying human physiology and disease mechanisms; in the development of diagnostic markers; and in the approach to prevention and treatment of diseases.

The science of medicine, similar to traditional biology, has adhered to the reductionist approach focussing on individual biological structures and components at different scales – from nucleic acids and proteins to organs, organisms, and species – in an effort to understand their various functions and dysfunctions. Medical researchers believe that changes in the behaviour of one or a few molecules are responsible for a given pathological condition and therapeutic strategies should aim at reversing the alterations to the normal state. Be that as it may, most physiological and pathophysiological phenomena are now recognized to result from the integration of complex interactions among the individual constituents of bodily systems. **Dhiraj Kumar and Kanury Rao** discuss the systems biology approach in understanding diseases. They reveal how crucial insights will emerge from the study of pathological phenomena as hierarchical systems or networks in which individual biological components interact in many and complex ways.

Ajit Varki describes how human evolution is relevant to medicine, citing examples of differences in disease prevalence between humans and human ancestors and demonstrating how some of the differences have a basis in dissimilar sialic acid biology.

Physicians have for a long time been in search for a marker which can be objectively measured and evaluated as an indicator of the disease processes, and could also be used to monitor responses to a therapeutic intervention. Advances in genomics and proteomics have generated several candidate biomarkers with potential clinical value. **Manoj Kumar and Shiv K Sarin** detail the characteristics of an ideal biomarker and the ways of identifying and evaluating them.

Michael Posner and Shobini Rao review the various methods developed for noninvasive exploration of human brain function and possible practical consequence of research in the domain of cognitive neurosciences. **Raman Kutty** traces the ascent of science in public health. He illustrates how ideas and methodological rigours of science helped to transform public health from a social science to a scientific discipline in its own right and in that process helped to understand ill health in a wider perspective, in identifying causes of diseases and in evolving strategies for prevention of diseases at the population level. **Savneet Kaur and C C Kartha** summarize the current concepts in stem cell biology and the important advancements as well as present limitations with respect to their prospective use in regeneration therapies in various human diseases.

Many challenges continue to exist in identifying diseases at the earliest possible stage and preventing and treating multifactorial diseases such as cancer and diabetes, as well as congenital and degenerative diseases. More demanding would be to generate affordable, safe medicines to a wide population, and assist the elderly to remain active as long as possible. What novel routes would medical scientists take to find answers to these demands?

C C Kartha