

Preface

The subject of the book, *Protein Modificomics: From modifications to clinical perspectives*, mainly takes into account the large set of modifications that occur to certain amino acid residues of a folded protein after protein translation and also the consequences of any undesired modification. These chemical modifications, collectively called posttranslational modifications (PTMs), mainly include, but are not limited to phosphorylation, glycosylation, ubiquitination, S-nitrosylation, methylation, N-acylation, lipidation, SUMOylation, etc.

The main purpose of a controlled PTM is to produce proteins with functional diversity beyond those encoded by the amino acids present in the polypeptide chains. In fact, PTMs expand nature's gamut by increasing the side chain inventory available to proteins. Knowledge of PTMs is enormously important as they bring about changes in the physical and chemical properties, conformation, folding, and stability of proteins, which ultimately affects the protein function. Importantly, many of such modifications are also involved in almost all of the biological pathways, namely, signal transduction, protein-protein interaction, cell-cycle, cell proliferation, apoptosis, cancer, etc. Nowadays understanding the protein structure-functional relationship therefore requires detailed information not only about its amino acid sequence, but also about the type of modification present on the protein. Furthermore, certain covalent modifications are the emblematic signatures of stressful conditions, for example, hyperglycemia, oxidative stress, hyperosmotic stresses, etc., and therefore are linked with various human patho-physiologies like diabetes, Alzheimer's disease, Huntington's disease, heart disease, age-related disorders, cancer, etc. Thus the allosteric insight into the regulation or deregulation of the protein structure due to modifications is of immense importance for the therapeutic intervention of diseases. PTMs also play a pivotal role in plant physiology and the production of medicinally important primary and secondary metabolites. Understanding of PTMs in plants will help us to enhance the production of these metabolites without greatly altering the genome. This will give us robust eukaryotic systems for the production and isolation of desired products without considerable downstream and isolation processes. Keeping in view the importance of PTMs in humans,

plants, and other microbial systems, a thorough insight into, if not all, most of the significant PTMs is important. Therefore the intention of this book was to comprehensively cover all aspects of PTM biology, that is, cell-process regulation, disease etiology, the ability to exploit different bio-systems to yield favorable results with our knowledge and understanding, translational modifications as a stress response, and also the role of PTMs in enhancing the efficiency of protein pharmaceuticals. In fact, we thought of compiling this edited book volume as, despite being so important to protein function, we could not find any comprehensive collection of PTMs of proteins viz-a-viz their importance in various cellular physiological processes, like stress response, signaling, etc., or their clinical perspectives in the literature.

The book comprises 13 chapters that are organized with the intention of providing an introduction to PTMs and then discussing their clinical perspectives and role in stress response. Chapter 1 includes the introduction to PTMs and their emerging role in various biological and disease processes. Chapter 2 describes the mechanism and diseases associated with nonenzymatic PTMs. Chapter 3 introduces the clinical perspectives of PTMs, while Chapters 4-7 describe the most significant PTMs, like phosphorylation, acetylation, ubiquitination, etc., and their role in human health and diseases. The role of these modifications in improving the pharmaceutical properties of the proteins has been described in Chapters 8 and 9. Chapter 10 describes the role of PTMs in cancer and their utilization in cancer therapeutics. Chapters 11 and 12 describe PTMs in other organisms, like plants and algae, in response to the environmental stress as an adaptive measure. The last chapter, Chapter 13, discusses the role of PTMs as markers for early disease diagnosis.

Growing knowledge about the biological role of PTMs on one hand and advancements in sophisticated analytical instrumentation on the other hand, have already led to an increased interest in PTMs. *Protein Modifications: From modifications to clinical perspectives* intends to serve as an important source of information not only for researchers and scientists working in the field of protein structure-function relationships, but also for people in the pharmaceutical industries.