

# Preface

The selenium field is expanding at a rapid pace and has grown dramatically in the last 10 years since the first edition of *Selenium: Its Molecular Biology and Role in Human Health* was published in 2001. All aspects of selenium biology have advanced with many new approaches and insights into the biochemical, molecular, genetic, and health areas of this intriguing element. In the first edition of this book, there were 25 chapters with 46 contributors that increased to 35 chapters with 71 contributors in the second edition. In the present edition, there are 45 chapters with 96 contributors. At this pace of expansion, and provided the fourth edition of *Selenium: Its Molecular Biology and Role in Human Health* is undertaken for publication in 2016, we can envision two volumes containing 29–30 chapters per volume with more than 125 contributors.

This book addresses many of the new and exciting discoveries that have occurred since the last edition was published in 2006. The numerous selenoproteins and proteins involved in the incorporation of selenium into protein that were described in the first two editions have been further characterized, new observations made, and mutant forms of some selenoproteins have been shown to be linked to human diseases. New factors have been detected that are involved specifically in the incorporation of selenium into protein. Mouse models targeting the removal of a specific selenoprotein, or removal of all selenoproteins, have further defined the role of selenoproteins in health and development. One of these has provided a potential model for Kashin-Beck disease.

Various aspects to glutathione peroxidase 4 (GPx4) are discussed in several chapters and its targeted removal suggested that it plays significant roles in proper function of numerous tissues and organs. GPx4 is now regarded as one of the more important selenoproteins in development. A role of selenium in cancer prevention has been purported for many years but we have learned in only the last few years that there are at least three selenoproteins that appear to have roles in preventing as well as promoting cancer. A role of selenium in male reproduction has also been purported for many years and the roles of specific selenoproteins in this process are now known and their functions elucidated.

Investigators in the selenium field are now looking at selenium differences in males and females and the role of selenium in pregnancy. In addition, the biosynthetic

pathway of selenocysteine in eukaryotes and archaea has been elucidated since the last edition – selenocysteine is not only the 21st amino acid in the genetic code but it was also the last known protein amino acid whose biosynthesis had not been resolved in eukaryotes and is the only known amino acid whose biosynthesis occurs on its tRNA in eukaryotes. Very recently, sulfur was found to replace selenium in the biosynthesis of selenocysteine in eukaryotes providing a novel pathway for cysteine biosynthesis that results in the replacement of selenocysteine with cysteine in selenoproteins.

The purpose of the present edition of the book is to bring readers up-to-date with the many new discoveries in the selenium field and to inform them of our present knowledge of the molecular biology of selenium, its incorporation into proteins as selenocysteine, and the role that this element and selenium-containing proteins (selenoproteins) play in health and development. In addition to being regarded as a chemopreventive agent, several other health benefits have been attributed to selenium. It has been touted as an inhibitor of viral expression and may prevent heart disease and other cardiovascular and muscle disorders, slow the aging process, delay the progression of AIDS in HIV positive patients, and have roles in development and immune function. Thanks to the many elegant techniques developed in recent years for examining selenium metabolism and selenoproteins in greater detail, investigators are now demonstrating how this element functions at the molecular level to bring about these many health benefits.

The present book is divided into four sections. Part I is entitled *Selenocysteine Biosynthesis and Its Incorporation into Protein* and it describes in detail our current understanding of the means by which selenium makes its way into protein as the 21st amino acid in the genetic code. Also discussed in this section are some of the reasons that selenocysteine may have evolved in protein and is used in place of cysteine in selenium-containing proteins. In addition, selenocysteine lyase, an important enzyme involved in selenium metabolism, is discussed. In Part II, entitled *Selenoproteins and Selenoproteins in Health*, many of the better characterized selenoproteins are examined including those that have been shown to play roles in health as defined by studies with rodents. Other chapters in this section examine such phenomena as selenoprotein hierarchy and the evolution of selenoproteins and their functions. The focus in Part III, entitled *Selenium and Selenoproteins in Human Health*, is on the role that selenium and selenoproteins play primarily in human health, while Part IV, *Mouse Models for Elucidating the Role of Selenium and Selenoproteins in Health* emphasizes the significance that mouse models have played in assessing selenoprotein roles in development and health.

The current edition of *Selenium: Its Molecular Biology and Role in Human Health* provides a most up-to-date examination of the on-going research in the selenium field. It is an important resource for investigators in the selenium field, other scientists, students and physicians, as well as those who wish to learn more about this fascinating micronutrient.

Bethesda, MD, USA  
Honolulu, HI, USA  
Boston, MA, USA

Dolph L. Hatfield  
Marla J. Berry  
Vadim N. Gladyshev

## Selenium

Its Molecular Biology and Role in Human Health

Hatfield, D.L.; Berry, M.J.; Gladyshev, V.N. (Eds.)

2012, XXVI, 598 p., Hardcover

ISBN: 978-1-4614-1024-9