

Preface

The first edition of *Selenium: Its Molecular Biology and Role in Human Health* was published in 2001 and largely covered the research in the selenium field for the preceding 30 years with special emphasis on “new and surprising insights into biochemical, molecular and genetic aspects of this fascinating element.” The book contained 25 chapters with 46 contributors. The selenium field expanded in the ensuing years, which was reflected in the second edition, published in 2006, containing 35 chapters with 71 contributors, and the third edition, published in 2012, which contained 45 chapters with 96 contributors. Marla Berry played a major role in the success of the second and third editions, which she coedited. In the present edition, Ulrich Schweizer and Petra (Peko) Tsuji are serving as coeditors.

The fourth edition of *Selenium: Its Molecular Biology and Role in Human Health*, like the previous ones, reflects the patterns of growth and diversity in the selenium field. The current edition contains 50 chapters and has 119 contributors. Some of the principal areas in the selenium field, which flourished the most during the last 5 years, are the continued in-depth analyses of functions and regulation of selenoproteins, primarily in human health and disease, and in particular, cancer. While many publications emphasize selenium as having chemopreventive activity, it has become apparent in the last few years that this element also has a role in promoting cancer, and this pattern most likely applies to other chronic disorders. In retrospect, selenium’s role in driving malignancies is not surprising, since unhealthy cells, and specifically cancer cells, require potent, robust systems that maintain their redox homeostasis and support rapid growth. Selenoproteins manifesting a “Dr. Jekyll and Mr. Hyde personality” in both preventing and promoting cancer, and the interplay of different oxidoreductase systems, are discussed in various chapters.

Interestingly, glutathione peroxidase 4 has recently been shown to have roles in cancer progression and ferroptosis, a form of non-apoptotic cell death, whereas research on thioredoxin reductase has highlighted the ever increasing roles of this important selenoenzyme in redox biology. It is also becoming clear that selenium-dependent deiodinases not only contribute to circulating thyroid hormone homeostasis, but their local regulation bestows on them key roles in organ development and stem cell biology, and thus affects wound healing and cancer progression.

Modern genetics has also played a major role in selenium research. Mouse models were instrumental in identifying physiological functions of selenoproteins. Currently, all but six selenoproteins have been individually inactivated in mice and interesting phenotypes have been discovered in many of the mice lacking a specific selenoprotein-encoding gene. In parallel, several inherited diseases affecting selenoproteins or their biosynthesis have been identified in humans, and the severity of the symptoms highlights the roles that selenoproteins play in human health. Many polymorphic forms detected in the genes of several selenoproteins have been reported to have different consequences on the corresponding selenoprotein function, including a strong association with disease.

Some important areas in the selenium field have largely been solved and/or have progressed slowly, but they have previously provided a wealth of information. A number of these areas, therefore, have also been included in the book to serve as a source for those readers not working specifically in the selenium field. In addition, inclusion of these findings makes this edition as complete as possible in representing most aspects of the selenium biology field.

Due to the discovery of all selenoprotein genes in mammals and elucidation of the roles of the resulting selenoproteins in cellular metabolism, health, and development, much of the selenium field has focused on selenoproteins in the last 15 years as reflected in the present and previous editions. Thus, the debate that existed in the selenium field at the beginning of this century, i.e., whether small molecular weight selenocompounds or selenoproteins were largely responsible for the many health benefits attributed to selenium, shifted the pendulum largely to the side of selenoproteins as the responsible benefactors. However, we anticipate that small molecular weight selenocompounds will, once again, come much more into focus reflecting selenium toxicity.

The current edition, which covers so many aspects of the selenium field by different investigators, naturally has insights and opinions that occasionally are at variance with each other. We consider these dissimilarities an asset to the reader as they illustrate how different investigators approach these issues and provide a better overall view of current research in the selenium field.

We were informed by Springer that the third edition of this book was in the top 25 % of all e-books published in 2014 with regard to copies acquired, views, and downloads. We hope the new edition with its further expanded scope will be as well received by the readers. It is an exciting time to be in the selenium field and contribute to it; and we look forward to what the future brings with regard to new discoveries involving this element, selenoproteins, and their roles in health and development.

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Selenium

Its Molecular Biology and Role in Human Health

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(Eds.)

2016, XXXI, 628 p. 88 illus., 59 illus. in color., Hardcover

ISBN: 978-3-319-41281-8