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Book Review

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Epigenetics in Human Disease, 2nd Edition

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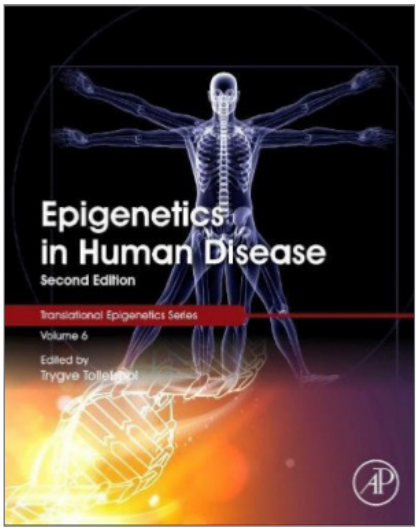

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The purpose of the 2nd Edition of this textbook is to update and highlight some diseases or conditions for which considerable epigenetic knowledge is available such as cancer, autoimmune disorders, and aging as well as some exciting breakthroughs in epigenetics including its impact on metabolic and neurological disorders. The target audiences for this book are medical students, scientists, and researchers working in genetics, biology, molecular biology, drug development, and pharmaceutics.

This textbook has 1110 pages, nine sections with 33 chapters authored by the 93 of the world's leading experts in genetics and epigenetics from 18 countries. The full text of the 1st edition is still available online through Elsevier eBooks.

The primary editor, Trygve O. Tollefsbol, is a professor and senior scientist at the University of Alabama at Birmingham. His research focuses on the field of aging, epigenetics, nutrition, cancer, telomerase, and caloric restriction. He serves as an editor for several international journals and has over a hundred publications and has published ten books. The current textbook is a giant in its field and provides a comprehensive resource for anyone interested in understanding the epigenetic basis of human disease, and those who are working in basic molecular biology, genetics, and clinical therapy.

The textbook is organized into main nine sections, including an introduction, methodology, human cancer, neurological disease, autoimmune disease, metabolic disorders, other diseases including allergy, cardiovascular disease, human infectious disease, endometriosis, gynecologic diseases. It also discusses the effects of epigenetics on human development, aging, and its transgenerational effects and explores areas for future research. Each part discusses the alteration of gene expression due to epigenetic changes, and the role of environmental factors, the therapeutic interventions in particular diseases and how future developments in epigenetics may impact the topic.

In general, epigenetics is the study of heritable changes in gene activity or function that are not associated with any change of the DNA sequence. This book addresses major epigenetic mechanisms involving direct chemical modification to DNA resulting from DNA methylation, chromatin modifications,

and noncoding RNA that have extensive and long-term effects on health. The Editor describes main concepts of the book in Section I including the essential role of epigenetics in normal development, and its role in a number of key processes including genomic imprinting, X-chromosome inactivation, and suppression of repetitive element transcription and transposition that, when dysregulated or altered, contribute to disease development and progression. Section II is devoted to the methods and strategies to detect epigenetic variation in human disease and also the epigenomic analysis strategy that focuses on chromosome band structures and chromosomal R/G band boundaries. The methodology covered in this section is important because it includes contemporary epigenetic topics, including advanced epigenomic and bioinformatics techniques using next-generation sequencing. Section III-VII describes the epigenetics of certain diseases, including cancer, neurological disease, autoimmune disease, metabolic disorders, and other common diseases.

In approaching this review, I chose to pivot my attention to the book's content regarding an area of personal interest, the epigenetic aberrations in human allergic diseases and therapy of airway diseases. This chapter covers regulatory mechanisms of allergy, epigenetic regulation of immune development and changes in cell composition; and most specifically, the epigenetics of eczema, food allergy, asthma, and allergic rhinitis. The authors summarized over 40 epigenetic markers predicting different allergic manifestations. Exploring and identifying these epigenetic risk factors will provide novel ways to prevent allergic diseases which are increasing worldwide. Interestingly, the risk for allergies risk can be transmitted across generations without the need for direct exposure of the child, and epigenetic processes can be induced in response to environmental exposures. Farming environment, air pollution, respiratory viral infection, developmental environment, gender and age, smoking, and nutritional exposures are considered common environmental exposures leading to allergy through epigenetic changes. Similarly, the next novel topic included in this volume is the epigenetics of transgenerational inheritance of disease which clearly explains the transmission of epigenetic information via the germline over multiple generations, independent of the DNA base sequence.

From my perspective, this textbook has a few weaknesses. The authors chose to not thoroughly discuss certain diseases and environmental effects in some chapters. As in most large books with multiple authors, the organization of the chapters varies, and there is not a consistent pattern to the figures and tables. However, in some areas, the linkage from basic science to clinical illness is outstanding and compared to other clinical texts, and the cellular and molecular aspects underlying certain diseases are well described. The authors included the latest references, and most of the chapters and tables provide citations that giving the readers a chance to explore the author's basis for their views.

Overall, for most readers, this book provides an important contribution to the understanding of epigenetic regulation as a basic molecular mechanism in the human body. For students, it will fulfill the reading requirements on the upper level of gene expression, which includes chromatin modification, DNA methylation, and miRNA targeting and includes clinical relevance to epigenetic influences on diseases such as cancer, autoimmune disorders, aging, also metabolic and neurological disorders, obesity, and cardiovascular disease. In addition, Section VIII describes stem cell epigenetics giving readers ideas for future research to obtain a better framework for understanding stem cell differentiation and proliferation. For researchers who are searching for a deeper understanding, it will be a concise review covering the common features of epigenetics and provides well-structured topics for further investigators. Also, this book outlines future potential targets for drug intervention based on molecular epigenetic interventions and disease prevention.

The future is bright for the field of epigenetics to help us better understand the basis for many diseases, and the field holds the promise of improved, and innovative treatments. The depth and breadth of knowledge on epigenetics supplied in this engaging book make it a worthwhile investment for the scientists, researchers, and students.