

Preface

Epigenetics has emerged as an important science with respect to health outcomes following several intriguing studies during the past decade. Epigenetics represents the study of gene regulatory factors that direct cell fates within the organism and that can be inherited via the germ line independent of Mendelian inheritance. It represents the next step beyond the Human Genome Project. Now that we can sequence genomes, we need to understand how genes are controlled in development. This will be a daunting task given the relationship of gene function to morphology and overall functioning; and gene–environment relationships in health, aging, and disease.

This work relates directly to our earlier Springer *Handbook of Children with Special Health Care Needs* (2012), edited by Dr. David Hollar, as well as to two unique Springer titles on epigenetics: *Epigenetics of Aging* (2010), edited by Dr. Trygve O. Tollefsbol, and *Environmental Epigenomics in Health and Disease* (2013), edited by Drs. Randy L. Jirtle and Frederick L. Tyson. The chapters in this book build upon and synergize these topics along the continuum of life from conception through aging and across generations via germ-line epigenetic inheritance. We also bring the topic in historical, biological, and health policy perspectives to public health professionals. Epigenetics has received increasing interest in public health, as evidenced by the October 2013 special issue of the *American Journal of Public Health* and conference sessions at the 141st and 142nd (i.e., 2013 and 2014) annual meetings of the American Public Health Association.

In this volume, 26 international experts and public health researchers have prepared chapters describing epigenetic mechanisms; the impact of epigenetics on pre-natal, child, and lifespan development; transgenerational epigenetic inheritance; and associations between epigenetic reprogramming and morbidity/mortality. The purpose of the book is to provide health researchers, clinicians, policy developers, and consumer advocates with a resource to inform their own work and to benefit epigenetic health worldwide. The topics are by no means exhaustive, but they provide relevant research findings and applications to public health and add to the growing epigenetic research literature. The chapters are provided in no particular order of importance, but I have arranged them beginning with an overview,

mechanisms, health risks, policy implications, and potential future research, although each author addresses specific topics related to their expertise.

Dr. David Hollar provides historical context, developmental biology research, general mechanisms, and applications to maternal and child health in Chap. 1. In Chap. 2, Drs. Milena Georgieva, Dessislava Staneva, and George Miloshev describe specific epigenetic molecular mechanisms and provide a fascinating model of epigenetic aging across the life span.

Dr. Marija Kundakovic follows in Chap. 3 with epigenetic mechanisms and how exposure to industrial toxins, specifically bisphenol A, impacts epigenetic reprogramming that impacts human health.

Drs. Emmy Rogakou, Vassilios Papadakis, and George Chrousos analyze the role of histones in epigenetic chromatin remodeling in Chap. 4, and they focus on the histone γ H2AX as a unique biomarker of epigenetic change. In Chap. 5, Drs. Sripriya Sundararajan and Cynthia Bearer explain how environmental exposures impact epigenetic programming during prenatal development, and they provide recommendations for preterm neonatal care in the neonatal intensive care unit (NICU). Dr. Xinyin Jiang provides a thorough description (Chap. 6) of research that demonstrates the impact of maternal and child nutrition on epigenetic reprogramming and health outcomes.

Moving to child and adult lifespan environmental exposures, Dr. John Kall, Amanda Just, and Dr. Michael Aschner compare and contrast (Chap. 7) the dental research literature and make a compelling case that mercury amalgam might promote serious health problems and disease via epigenetic mechanisms. In Chap. 8, Drs. Chris Murgatroyd and Steven Bradburn describe how translational animal model research has informed our knowledge of epigenetic mechanisms in disease processes. Likewise, Dr. Ping Hu discusses how pluripotent stem cells (Chap. 9) are regulated to be static or to differentiate.

Drs. Jay Schneider and Deborah Cory-Slechta (Chap. 10) describe lifespan neurodevelopmental effects of prenatal lead, stress, and combined exposures. In Chap. 11, Jennifer S. Lewis provides a review of neurodevelopment and then relates epigenetics and physiology to post-traumatic stress disorder (PTSD).

Dr. Steven Gilbert addresses the various individual and social levels of ethical responsibility given the epigenetic effects from environmental toxins (Chap. 12). Dr. Caroline Hohensee, Tricia Varela, and Dustin Harris explore research indicating possible relationships between epigenetics and child obesity (Chap. 13), and Dr. Lisa Melvin examines (Chap. 14) similar potential relationships for child exposure to alcohol, tobacco, and other drugs (ATOD). Dr. Ankita Das explains epigenetic memory and plasticity in embryonic development (Chap. 15).

Dr. David Hollar concludes the book with Chap. 16, exploring recent theoretical work linking genomic molecular instability to cancer, aging, and diseases linked to epigenetic reprogramming. This includes discussion of targeted epigenetic reprogramming to potentially reverse negative epigenetic regulation at the gene system, cell, tissue, and organism levels. It also suggests a mathematical measure of epigenomic change using nonlinear dynamics parameters.

The authors thank their families and colleagues. I thank the authors for their expertise and teamwork in the completion of this project. I thank Springer editors Janet Kim, Khristine Queja, Bill Tucker, and Christina Tuballes for facilitating the development and publication of the book, plus Saswat Mishra and Deepthi Vasudevan for editing and proofing. I thank my family, Brooke, Paige, Virginia Dean, Beverly and Edward Merritt; Dr. William Virtue; and Drs. Vernease Miller, Barnett Parker, and my many colleagues at Pfeiffer University for their faith, interest, and support for this project.

Misenheimer, NC
July 31, 2015

David Hollar

Epigenetics, the Environment, and Children's Health
Across Lifespans

Hollar, D. (Ed.)

2016, XXI, 386 p. 24 illus., 16 illus. in color., Hardcover

ISBN: 978-3-319-25323-7