


Chapter 3

Endocrine Disruptors and DNA Damage: Mechanisms, Risks, and a Public Health Implications

Mamta Singh

 <https://orcid.org/0009-0002-9702-9119>

Sri Ramachandra Institute of Higher Education and Research, Chennai, India

ABSTRACT

Endocrine disruptors, which are environmental chemicals, interfere with hormone regulation and increase health risks. This chapter examines the DNA-damaging effects of EDs, which lead to mutations, genomic instability, and the development of cancer. Key molecular mechanisms include oxidative damage, epigenetic alterations, and receptor-mediated abnormalities that result from EDs exposure and associated health issues. It also discusses the risks of endocrine disruptors for pregnant women and children, as well as other vulnerable population groups. The discussion encompasses public health implications as well as regulatory standards for risk evaluation and methods to minimize exposure. Future directions include advancing biomarker development, refining risk assessment models, and designing safer chemical alternatives to reduce exposure.

1. INTRODUCTION

Environmental chemicals in the class of endocrine disruptors function as hormone mimics while blocking hormone production, transport, and binding and removal. The industrial and pesticide products, along with plastics, cosmetics, and domestic use products, contain BPA (Bisphenol A), phthalates, DDT (Dichlorodiphenyltrichlo-

DOI: 10.4018/979-8-3373-5796-6.ch003

roethane), PCBs (Polychlorinated Biphenyls), and phytoestrogens. These harmful substances remain in the environment and human bodies, leading to severe health problems. Multiple observational studies, together with experimental findings, have shown that EDs trigger carcinogenesis while causing metabolic disorders, reproductive issues, and neurodevelopmental disorders.

1.1. Endocrine Disruptors (EDs) and DNA Damage

The exposure to Endocrine Disruptors results in DNA damage, which occurs either directly or indirectly by producing reactive oxygen species that affect DNA bases and chromosomes. Certain EDs modify DNA methylation patterns as well as histone modifications while keeping the DNA sequences unaltered. The simultaneous occurrence of epigenetic modifications and DNA damage results in cancer development and diseases. Breast cancer cells grow faster when exposed to BPA along with other EDs through mechanisms that activate estrogen receptors. Phthalates serve as a prevalent ED that results in testicular dysgenesis while producing cancer-causing effects. The development of cancer occurs when DNA damage pairs with hormone disruption caused by Endocrine Disruptors.

1.2. Structure and Scope of the Chapter

This chapter starts with a brief overview of Endocrine Disruptors and their origins. The following section explains EDs and DNA damage and their effects on human health. The following section investigates how DNA repair mechanisms work in cancer formation and their impact on fertility and metabolic syndrome. The chapter analyzes how EDs contribute to disease development in vulnerable patient groups. The chapter section addresses how the reader can implement public health policies, regulatory standards, and prevention measures for ED production.

2. ENDOCRINE DISRUPTOR: DEFINITION, ED SOURCES, AND EXPOSURE ROUTES

2.1. Definition

According to the World Health Organization/IPCS (2002), Endocrine disruptors (EDs) are exogenous substances or mixtures that interfere with hormone action and cause adverse health effects in the whole organism, its progeny, or (sub)population.

36 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/chapter/endocrine-disruptors-and-dna-damage/385533

Related Content

Investor-State Dispute Settlement (ISDS) in the Energy Sector: A Poisonous Gift for Developing Countries?

Delphine Defossez (2022). *Handbook of Research on Energy and Environmental Finance 4.0* (pp. 1-24).

www.irma-international.org/chapter/investor-state-dispute-settlement-isds-in-the-energy-sector/298743

The Impact of Climate Change on Small Ruminant Performance in Caribbean Communities

Cicero H. O. Lallo, Sebrena Smalling, Audley Faceyand Martin Hughes (2017). *Environmental Sustainability and Climate Change Adaptation Strategies* (pp. 296-321).

www.irma-international.org/chapter/the-impact-of-climate-change-on-small-ruminant-performance-in-caribbean-communities/170318

The Interplay Between CES1 Gene Polymorphisms and Environmental Exposures in Chemotherapy Toxicity in Breast Cancer: CES1 Variants and Environment in Chemo Toxicity

Duygu Aygunes Jafari, Canfeza Sezginand Buket Kosova (2026). *Environmental Factors in Carcinogenesis: Exposome-Driven Insights Into Cancer Risk and Prevention* (pp. 259-302).

www.irma-international.org/chapter/the-interplay-between-ces1-gene-polymorphisms-and-environmental-exposures-in-chemotherapy-toxicity-in-breast-cancer/385535

Applications of Artificial Intelligence and Remote Sensing in Water Resources Management

Wasiq Farooq, Muhammad Safdar, Hamza Anjum, Muhammad Adnan Shahid, Muhammad Sajid Mehmood, Amina Rashid, Abdul Rauf, Fahd Rasul, Imran Shauket, Naeem Saddique, Hafiz Muhammad Bilawal Akramand Muntaha Munir (2026). *Advancing Environmental Research Through Applied GIS and Remote Sensing* (pp. 147-174).

www.irma-international.org/chapter/applications-of-artificial-intelligence-and-remote-sensing-in-water-resources-management/393487

Municipal Solid Waste Management

Jaison Chatsiwa, Never Mujereand Avhatendi Bethania Maiyana (2016). *Handbook of Research on Waste Management Techniques for Sustainability* (pp. 19-43).

www.irma-international.org/chapter/municipal-solid-waste-management/141888