ecDNA Knowledge for Personalized Medicines

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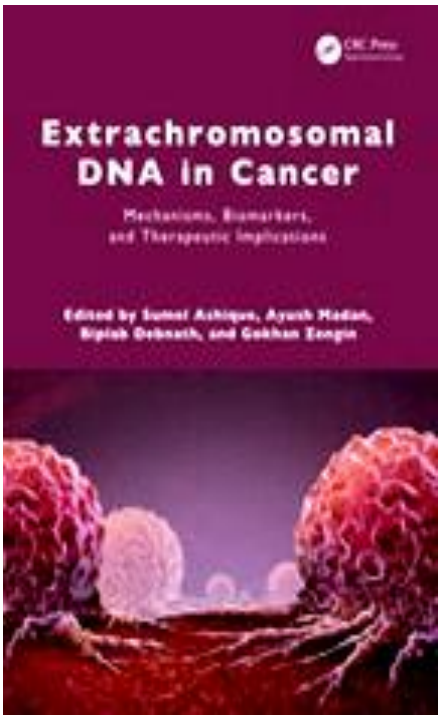

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Abstract: The concept of personalized medicine (PM) makes it possible to predict whether a particular therapy will be effective for a particular patient. PM is a medical treatment that tailors prevention and treatment strategies for an individual patient. Before its successful implementation in healthcare systems, there are various barriers and challenges that need to be identified. However, it is essential to remember that PM is not a medical revolution but an evolution. Hence, biomarkers are very important to understand the diseased or clinical state of the individual. Extrachromosomal DNA (ecDNA) is known as a class of circular, non-chromosomal DNA. In the present circumstances, its knowledge has gained widespread attention because of its potential role in the development of aging, cancer, and neurodegenerative diseases. The generation of ecDNA is closely associated with the outcome of processes such as double-strand breaks, micronuclei formation, and the breakage–fusion–bridge (BFB) cycle. All progress helps to regulate the expression of genes and their stability, along with clonal evolution. The aberrantly developed ecDNA is an indicator for the development of cancer and several neurodegenerative diseases, as it is related to the defects in DNA repair, synaptic plasticity, and dysfunctions of neurons. Hence, ecDNA-like biomarkers play a significant role in the understanding of the pathophysiology of diseases and allow scientists to find therapeutic targets to treat them. This chapter explores the understanding of extrachromosomal DNA (ecDNA) as a substantial clinical problem (progress of tumor growth signals and decrease of immune system) and its profound implications for personalized medicine, with a particular emphasis on cancer.