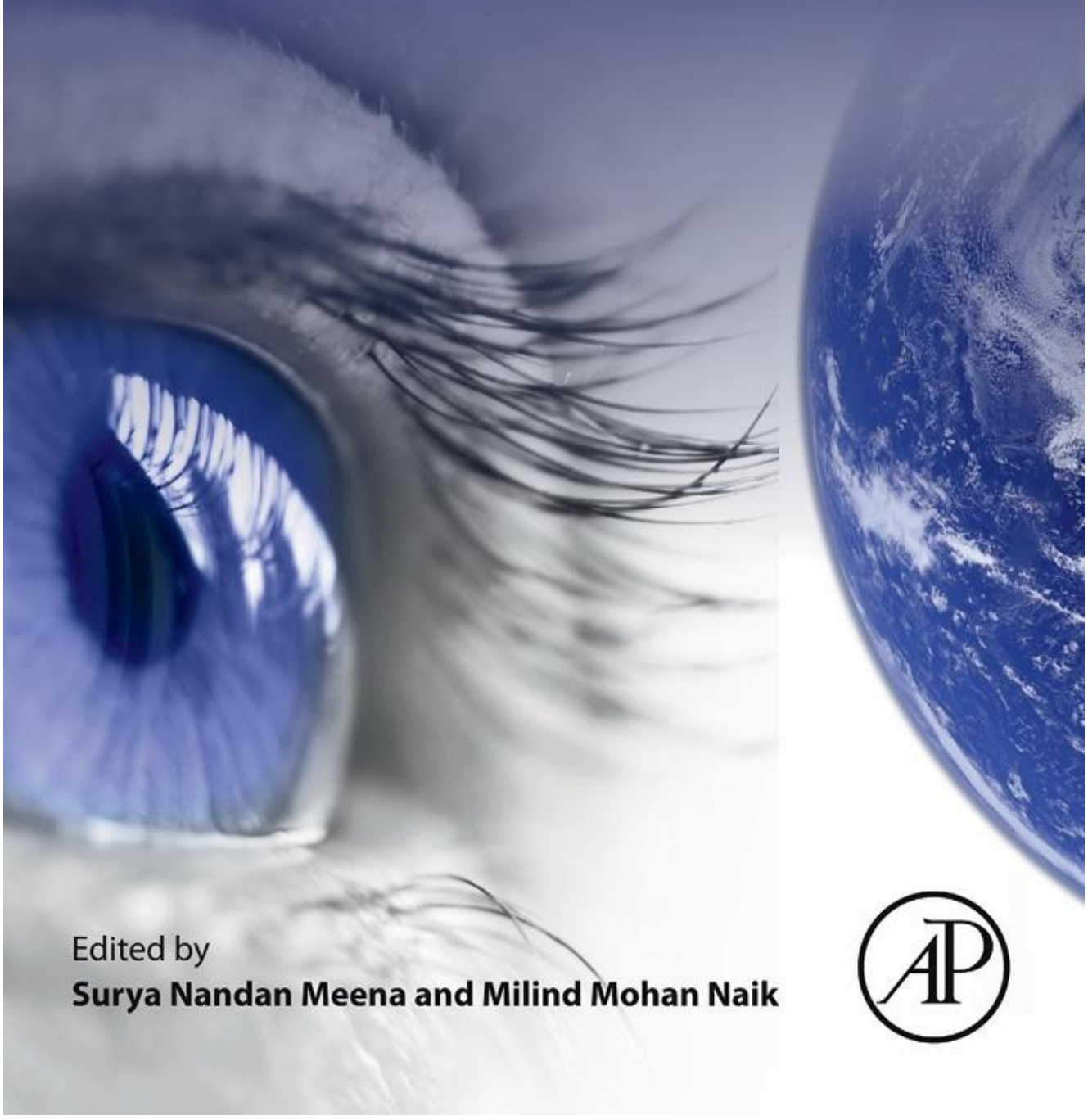
Advances in Biological Science Research

A Practical Approach



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Chapter 18

Genotoxicity assays: the micronucleus test and the single-cell gel electrophoresis assay

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18.1 Introduction

All organisms are constantly exposed to various factors that can cause damage not only at the cellular level but also at the level of DNA. These factors may either be chemical substances, radiation, dusts, biological toxins, etc., which may affect DNA directly or indirectly thereby resulting in genotoxic effects. Genetic toxicology is a branch of toxicology that deals with the studies on the genotoxic effects of substances, especially the induction of mutation by chemical means. It investigates the interaction of chemical and physical agents with genetic material, in relation to subsequent adverse effects, such as cancer (in case of alterations in somatic cells) or genetic disease in future generations (in case of alterations in germ cells). In other words, genetic toxicology is a branch of toxicology that identifies and analyzes the action of agents with toxicity directed toward the hereditary components of living systems. It can be widely implemented for identifying the genotoxic agents found in the environment, whose presence may alter the integrity of the gene pool of a wide range of organisms including human beings. It can also be used for the detection and mechanistic understanding of the action of carcinogenic agents. In vitro genotoxicity tests are usually used for screening the genotoxic potential of different substances such as pesticides, nanomaterials, pharmaceuticals, extracts, etc. and can be used as initial toxicity data prior to in vivo testing. If in vitro test results are positive, then in vivo genotoxicity testing can be done to ascertain if the substance causes toxicity in a living animal model. This is of great significance because in living systems, substances can get metabolized into more-harmful or even less-harmful forms and can get

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