Genotoxic Potential of Radiofrequency Exposures

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Abstract

In genetics, the term genotoxicity describes the action of physical agents, such as chemicals and ionising radiation, which results in damage to genetic material encoded in deoxyribonucleic acid (DNA), and can take many forms. Markers of genetic damage include single strand and double strand DNA breaks, DNA base damage, chromosome aberrations and micronuclei induction. It is well-recognised that genetic damage is a major pathway to carcinogenesis.

There has been much debate over the last 30 years as to whether man-made radiofrequency radiation is genotoxic. With a number of narrative reviews, Ruediger's review in 2009 found 49 studies reporting a genotoxic effect while 42 did not, and more recently, a review by Lai in 2021 found 237 or 66% of studies had a significant effect while 124 or 34% did not. Both papers provide a summary of the current state of science with a "balance of evidence" finding. Further, both suggest some possible reasons for the discrepancies. However, such reviews can only best be described as superficial, as neither of these papers investigated in depth (using meta-analysis techniques) about how experimental methodology and parameters used may affect outcomes.

A search of the ORSAA database has identified over 350 papers investigating RF exposures and genotoxicity. A comprehensive data set was then constructed by capturing important comparable parameters from the collection of identified studies. Example parameters include: experiment type (in vivo, in vitro, epidemiological); funding source; cell type (primary vs cell line); species; RF generation source; carrier wave frequency and signal modulation used; number of sequential exposures; duration of exposures; intensity of the signal; DNA damage assay type; sacrificial method (animal studies); time between exposure cessation and commencement of assay. These parameters and their inter-relationships were methodically analysed.

The resulting comprehensive data set provides valuable insights into how some of these parameters can have significant influences on study results and identifies the main drivers contributing to the mixed findings. The data set also shines a light on methodological limitations and issues that will need to be addressed in future studies in order to further clarify the genotoxic potential of radiofrequency exposures. The preliminary findings to be presented are likely to have far-reaching implications to our understanding of radiofrequency exposure in relation to health and safety. The findings also bring into question the applicability of the current RF Standard (ARPANSA 2021) and RF Guidelines (ICNIRP 2020) for providing suitable protection to all species, not just humans.

Key Words

Electromagnetic Radiation, EMR, EME, EMF, RF, Microwaves, Wi-Fi, Mobile phones, Health, Cancer, Genotoxicity, DNA Damage, DNA Breaks, Chromosomal Aberrations, Micronuclei Induction.