W14–3 Direct Observation of Long-lived Radicals in Irradiated Mammalian Cells which Cause Mutation

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We have succeeded in quantitative measurement of long-lived radicals (LLR) in irradiated mammalian cells directly by electron spin resonance (ESR) spectroscopy. Although we have reported the induction of mutation by LLR in irradiated mammalian cells for several times, most of researchers have not accepted our results because any DNA damage were not included in the mechanism of inducing mutation by LLR. Recently Hei et al. proved that DNA damage was not necessary to induce mutation as bystander effect. Therefore, LLR are still important for induction of mutation in the irradiated cells. Our results in the measurements of LLR by ESR and ESE (Electron Spin Echo) are introduced in below. LLR were scavenged by *L*-ascorbic (AsA) acid and (–)-epigallocatechin-3-*O*-gallate (EGCG), accompanying with the suppression of mutation simultaneously. The reaction between LLR and AsA proceeded in atomic tunneling in the cells. Very recently we have assigned that LLR are produced in protein as sulfinyl radicals by ESE and ESR measurements. Therefore, we speculate that LLR are produced in some enzymes related to DNA synthesis.

W14–4 Detection of Radiation-Induced DNA Damage by an Aldehyde Reactive Probe (ARP)

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Ionizing radiation produces a variety of oxidative base lesions in DNA. To understand the molecular mechanism of biological effects of ionizing radiation, it is essential to monitor the dynamic process of damage formation and repair based on the amount of DNA damage. We have previously developed an assay to quantify abasic (AP) sites using an aldehyde reactive probe (ARP). Since base excision repair (BER) enzymes remove damaged base from DNA, leaving an AP site, it is possible to quantify base lesions by the ARP assay coupled with BER enzyme treatment. Genomic DNA was extracted from *Escherichia coli* and HeLa cells and DNA treated with and without endonuclease III recognizing oxidative pyrimidine damage was subjected to the ARP assay. The results showed that DNA from *E. coli* and HeLa cells contained roughly 7 and 8 pyrimidine lesions per 10^6 nucleotides. The results obtained with irradiated DNA *in vitro* and DNA extracted from irradiated cells will be also reported.

W14–5 Why is There No Oxygen Effect in High LET Radiation Exposure?

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RBE of ^{3}H β-rays has been reported as 1–3. This author studied radiolysis of water with ^{3}H β-rays. An UV spectrum other than OH, O_2H and H_2O_2 was observed in water contained HTO. Since mesityl oxide was oxidized to its epoxide, the above active species could be assigned to nascent oxygen (O). A nascent oxygen corresponds to two OH radicals for oxidative reactions, which implicates the formation of heavy damage. The nascent oxygens react not only with solute molecules but also with each other producing O_2 molecules. Therefore, the irradiation condition becomes to be the same to that under O_2 being due to the production of O_2, even if solution was exposed to radiation in the absence of O_2. The heavy damages may remain as unreparable damages. Really, RBE of ^{3}H β-rays to ^{60}Co γ-rays becomes higher at lower dose-rate.