Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

A new model for biological effects of radiation and the driven force of molecular evolution. TAKAHIRO WADA, Department of Pure and Applied Physics, Kansai University, YUICHIRO MANABE, Division of Sustainable Energy and Environmental Engineering, Osaka University, HIROO NAKAJIMA, Department of Radiation Biology and Medical Genetics, Osaka University, YUICHI TSUNOYAMA, Radioisotope Research Center, Kyoto University, MASAKO BANDO, RCNP, Osaka University — We proposed a new mathematical model to estimate biological effects of radiation, which we call Whack-A-Mole (WAM) model. A special feature of WAM model is that it involves the dose rate of radiation as a key ingredient. We succeeded to reproduce the experimental data of various species concerning the radiation induced mutation frequencies. From the analysis of the mega-mouse experiments, we obtained the mutation rate per base-pair per year for mice which is consistent with the so-called molecular clock in evolution genetics, 10^{-9} mutation/base-pair/year. Another important quantity is the equivalent dose rate for the whole spontaneous mutation, $d_{\rm eff}$. The value of $d_{\rm eff}$ for mice is $1.1*10^{-3}$ Gy/hour which is much larger than the dose rate of natural radiation ($10^{-(6-7)}$ Gy/hour) by several orders of magnitude. We also analyzed Drosophila data and obtained essentially the same numbers. This clearly indicates that the natural radiation is not the dominant driving force of the molecular evolution, but we should look for other factors, such as miscopy of DNA in duplication process. We believe this is the first quantitative proof of the small contribution of the natural radiation in the molecular evolution.

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Date submitted: 05 Nov 2015 Electronic form version 1.4