Analysis of Biological Responses to Low Dose-rate Radiation at the Molecular Level - Expression of Senescence Marker Proteins

Takashi SUGIHARA, Satoshi TANAKA, Ignacia TANAKA, Jun-ichiro KOMURA
Department of Radiobiology

Abstract

Previously, we have shown that the exposure of mice to low dose-rate (LDR; 20 mGy/day) radiation shortens the life span and induces early emergence of some neoplasms and non-neoplastic lesions, which seems to support the hypothesis that radiation accelerates aging. To further study the influence of LDR radiation on aging, we examined the expression of the genes for senescence marker proteins-2 and -30 (Smp2 and Smp30) in livers of LDR-irradiated mice. Liver samples for RNA extraction were collected every 100 days (beginning at day 100 from the start of irradiation to day 700) from female SPF B6C3F1 mice irradiated at 20 mGy/day for 400 days from 8 weeks of age. Using real-time PCR to analyze the RNA, we observed that the expression of the Smp2 gene, which has been reported to increase with age, was significantly decreased in irradiated mice beginning at day 300 from the start of irradiation. This result is inconsistent with the hypothesis of radiation-accelerated aging and may indicate that the expression of the Smp2 gene is influenced by other factors such as androgen levels. On the other hand, the expression of the Smp30 gene, which has been reported to decrease with age, was significantly decreased in irradiated mice from day 400, and is consistent with the hypothesis of radiation-accelerated aging. The Smp30 protein has been also reported to be an enzyme necessary for the synthesis of vitamin C, which is thought to be an anti-aging substance.

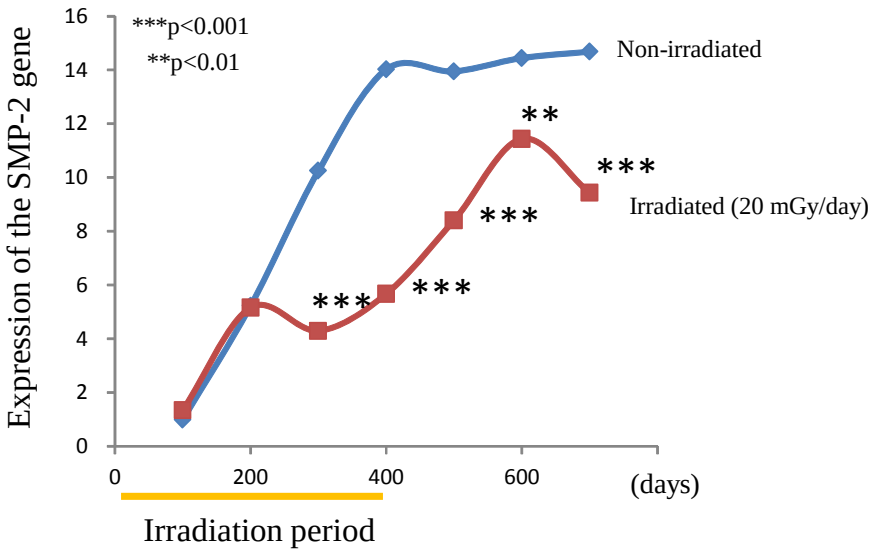

Fig. 1 Expression of the gene for the senescence marker protein-2（SMP-2）in the liver of B6C3F1 female mice. The SMP-2 expression level is normalized using the Gapdh gene as a control.

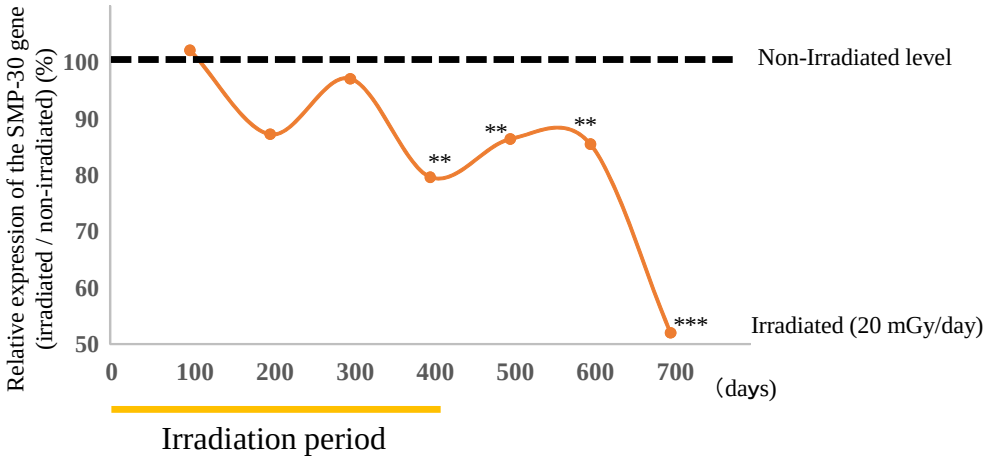

Fig. 2　Relative expression of the gene for the senescence marker protein-30（SMP-30）in the liver of B6C3F1 female mice.