

Translocations¹ are induced in hematopoietic stem cells² after irradiation of fetal mice³

Mammalian fetuses are considered to be highly sensitive to radiation, but in studies of lymphocyte⁴ chromosomes⁵ in the blood of in-utero exposed, A-bomb survivors as adults, no increase in frequency of chromosomal translocations was observed with increased radiation dose. That situation lends support to the hypothesis that chromosomal aberrations in fetal hematopoietic cells do not occur or, if they do, the cells with abnormalities disappear before adulthood.

In this study, pregnant mice (12.5–15.5 days after fertilization) were whole-body irradiated with 2 gray (Gy)⁶ of X-ray irradiation. Subsequently, 24 hours later, hematopoietic stem cells from maternal mice and their fetuses were isolated. From a single hematopoietic stem cell of both the mother and the fetus, the chromosomes of clone cells (genetically identical cells) proliferated in vitro (within test tubes) were examined.

As a result, fetal mouse hematopoietic stem cells were observed to have chromosomal aberrations (translocations), although the frequency was lower than that in the maternal mice 24 hours after their exposure. Based on that finding, it is believed that hematopoietic stem cells with translocations are generated in fetal mice but then disappear by the time the mice become adults, resulting in a translocation frequency around the same level as that found in non-irradiated mice. Further research is needed regarding this process marked by the disappearance of hematopoietic stem cells with translocation-type chromosomal aberrations caused by radiation exposure.

Notes

¹ Translocations: Refers to the phenomenon of partial replacement of chromosomes that can occur after chromosome breakage caused by cell damage from radiation, etc.²

² Hematopoietic stem cells: Cells that reside in the bone marrow and can form all the different types of blood cells (white blood cells, red blood cells, and platelets) and supply blood throughout life.

³ Mouse fetus: A baby mouse residing in the mother's body.

⁴ Lymphocytes: A type of white blood cell, one component of blood, that is involved in immune function.

⁵ Chromosomes: Chromosomes, comprised of DNA, are biological material responsible for the expression and transmission of cellular genetic information. Human somatic cells contain 23 pairs of chromosomes (46 total chromosomes).

⁶ Gray (Gy): Gray (1 gray = 1,000 milligray) is a unit of radiation that represents the amount of radiation dose absorbed by a substance when it is exposed to radiation. The average dose for RERF's LSS participants is around 140–200 milligray (0.14–0.2 Gy). As reference, the average annual amount of radiation we are all exposed to in our daily lives, including medically, is estimated to be around 2–6 milligray (0.002–0.006 Gy).

doi.org/10.1093/jrr/rrac078

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RERF's objective with this brief outline is to succinctly explain our research for the lay public. Much of the technical content of the original paper has been omitted. For further details about the study, please refer to the full paper published by the journal.