Cataracts Heavy Ions and Individual Susceptibility

E. J. Hall1, B.V. Worgul2, D.J. Brenner1, L. Smilenov1

1Center for Radiological Research, 2Dept of Ophthalmology, Columbia University, New York, NY. USA

ejh1@columbia.edu/Phone:+1-212-305-5660

Ocular cataracts represents one of the few legacies of space flight evident in a significant proportion of astronauts. X-rays are known to induce cataracts. Heavy ions are known to be much more effective per unit dose than γ-rays. The object of this present study was to identify genes that confer individual susceptibility, and to estimate RBE values.

Wild type mice were compared with animals heterozygous for Atm, Mrad9 or BRCA1, or animals that were double heterozygotes for pairs of genes. Mice were irradiated with x-rays at Columbia University in New York City or with heavy ions (1GeV/amu ^{56}Fe ions) at Brookhaven National Laboratory. Haploinsufficiency for either Atm or mRAD9 resulted in cataracts appearing earlier than in wild type animals whether exposed to γ-rays or heavy ions. Double heterozygotes were more radiosensitive than animals haploinsufficient for either gene alone.

Heavy ions were much more effective than x-rays in inducing cataracts of all grades in animals of all genotypes. A detailed analysis suggest that the RBE varies to some extent with the genotype of the animal and the cataract grade.