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OER for Mixed Neutrons and γ Rays

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A formula for the OER in a mixed field of neutrons and gamma rays (Hall, 1972a; 1972b) is given as

$$O_{\mathrm{mix}} = \mathrm{O_n O_\gamma}[1 + p_{\mathrm{n}}(Rn - 1)]/[O_\gamma R_{\mathrm{n}} p_{\mathrm{n}} + O_{\mathrm{n}}(1 - p_{\mathrm{n}})]$$

where R_{n} is the RBE of neutrons relative to γ rays under aerated conditions, O_{mix} is the OER for the mixture of neutrons and γ rays, $\mathrm{O_n}$ and $\mathrm{O_\gamma}$ are the OERs for neutrons and γ rays, respectively, and p_{n} is the proportion of absorbed dose due to neutrons. Recent calculations of the survival, RBE, and OER of kidney cells in a mixed field of 14 MeV neutrons and γ rays (Katz and Sharma, 1974) made for comparison with experimental findings with Chinese hamster ovary cells (Railton *et al.*, 1974) were in good agreement with the Hall formula. In consequence, we have explored the matter more fully, calculating O_{mix} for neutrons of different energies (0.5, 1.0, 2.0, 14 MeV, and mean energy 7.5 MeV having the energy spectrum of the Hammersmith Hospital generator), onto different cells (HeLa, leukemia, human kidney), at a range of survival levels (1, 10, 20, 50, 90 per cent). Our results, calculated from track structure theory (Katz and Sharma, 1973) and secondary particle-energy spectra in tissue from these neutrons (Caswell and Coyne, 1973; Dennis, 1972) are within 5 per cent of the values of O_{mix} found from the Hall formula, when that formula is supplied with calculated values of R_{n}, O_{n}, and O_γ, at appropriate survival levels. Our calculations suggest that the Hall formula may be used with confidence for neutrons of different energies and for pions.

Yours, etc.,

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