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Evolution of a Good Application of Physics (The Treatment of Cancer by Radiation)

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The use of ionizing radiation for the treatment of Cancer is an example of an appropriate application of Physics to the field of Medicine. Something like three quarters of a million people die of this terrible disease in Canada every year. The use of radiation to eradicate a tumour has about the same success rate as does surgery, and each have their specific advantages. Biologists, Chemists and Physicists have determined that radiotherapy has a sound scientific basis. A physical quantity, Radiation Absorbed Dose, which is the energy absorbed per unit mass of tissue, is quantitatively relatable to biological effect. Careful clinical trials have indicated that an accuracy of about ±5% in the delivery of the planned dose to the patient is required. Since this includes the repeated positioning of the patient for treatment, the accuracy requirement on dose prediction is tighter and quite difficult to achieve. Prediction of the pattern of dose involves the repeated application of a non-linear superposition integral, which even with the assumption of tissue homogeneity, has no solution in closed form. Approximate solutions must be accepted, and part of the "evolution" has been the search for ever better approximations. Early approximations were remarkably crude, but with development of computer methods they have become quite sophisticated. Nevertheless, they are still approximations. With the availability of Monte Carlo methods, the problem has been substantially solved, though not for routine use. The evolution will not be finished however until biological response can be related to the radiation dose.

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