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The Nuclear Reactor as an Instrument in Medical Therapy

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On Feb. 15, 1951, at Brookhaven National Laboratory a reactor was used for the first time as an instrument of medical therapy. Since 1949 the Medical Department at Brookhaven has been working on this problem which has grown extensively, particularly during the past few years. The possibility of using thermal neutron capture for treatment of malignant disease was suggested by Locher[1] in 1936 not long after the discovery of neutrons. In 1940, Kruger[2] at Berkeley, Zahl et al.,[3] and Zahl and Cooper[4] at Columbia reported independently on studies using the capture reaction of boron and lithium in mouse tumors. In each instance the neutrons were obt[illegible] by means of an accelerator and were relatively few in number compared to the numbers r[illegible]sed. The development of nuclear reactors in the early 1940's gave promise of an adequate device for this purpose, and our efforts to apply reactors to this purpose in the 1950's have served further to stimulate scientists and physicians to seek the solution of this problem.

During the period from February 1951 to January 1953 10 hospital patients at Brookhaven were treated at the reactor with thermal neutrons. Each of these patients had glioblastoma multiforme, and in each instance a large dose of B^{10} as borax was administered intravenously immediately before thermal neutron radiation. The Brookhaven reactor was used for this series of treatments exactly as it had been constructed, except for minor alterations in shielding at the site of the medical treatment port atop the reactor. The conditions of reactor operation required that at time of positioning the patient over the port and until a reasonable accumulation of capture element might be expected in the tumor, no thermal neutron radiation was indicated. After some 8 min, a maximum exposure to thermal neutrons was desired promptly, before the tumor might discharge its large load of boron. This meant that the reactor had to be brought very rapidly from zero power activity to its full rated power for the treatment, usually about 30 Mw. The control and safety mechanisms of the reactor had not been designed with this type of operation in mind, and it is a tribute to its designers that the reactor had sufficient flexibility to meet such an unusual demand. At the same time our knowledge of the pharmacology of boron was woefully inadequate for this type of administration, and it was necessary to undertake extensive preliminary studies in order that safe procedures might be outlined. It is apparent that under such circumstances a sufficient number of varied therapeutic trials had to be made to determine the feasibility of the procedure before a very extensive commitment of time and money to the endeavor could be made. Therefore, in the first series of patients treated, some individuals received single treatments, whereas others received multiple treatments up to four at not less than one month intervals, with one exception. Clinical observations were carefully made to determine whether any favorable effects would result a[illegible]ether any toxic manifestations would appear, either from the large dose of capture elem[illegible]or from the neutron exposure.[5,6] By 1953 we were certain that the procedure was feasible and that further informative studies could be carried out with the Brookhaven reactor without

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