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## Biological Effects of Fast Neutrons from an Internal Target Cyclotron: Physical Methods and Dominant Lethals in *Drosophila*<sup>1</sup>

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### INTRODUCTION

For radiobiological studies in which equal doses of different radiations are given, a challenging result of basic interest emerges. Radiations of different ion density (linear energy transfer, LET) can, under certain conditions, have different effects (1). A number of investigations have been made of the effects of fast neutrons from the Oak Ridge National Laboratory 86-inch cyclotron. Mammalian pathological effects have been discussed elsewhere, along with a description of the associated dosimetry (2, 3). Preliminary reports of a number of cytogenetic effects have been given (4-8). In this paper, further mutational studies on *Drosophila* will be presented.

Since a description of physical methods used in measuring dose is essential for proper evaluation of biological results, a more comprehensive discussion will be given here, including: (1) an upward revision of neutron doses published in earlier reports; (2) a report on results of independent confirmation of earlier work, when so revised; and (3) a description of typical errors in neutron dosimetry.

### PHYSICAL CONSIDERATIONS

*Exposure setup.* The ORNL 86-inch cyclotron is constructed vertically (9) and, in this respect, differs from most machines in that the magnetic field is horizontal and the dees hang vertically into the vacuum chamber. An internally located target consisting of a thin layer of beryllium bonded to an aluminum backing was used (Fig. 1). The bottom tips of the dees are recessed slightly, and the target is mounted horizontally between them. The broad beam of protons of 22-Mev energy, after completing its final orbit, strikes the target over an area usually 3 to 4 inches square,

<sup>1</sup> Work performed under Contract W-7405-eng-26 for the U. S. Atomic Energy Commission.

<sup>2</sup> The first five authors obtained the physical measurements and provided the statistical analysis, and the last two authors conducted the biological experiments reported.



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