THE FERMILAB CANCER THERAPY FACILITY: A MEDICAL PROGRESS REPORT

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The Fermilab Cancer Therapy Facility has now been treating patients for the past three years. More than 600 patients have now been evaluated, the great majority of whom were treated in the neutron facility. Evaluation of this clinical research project is continually in process, but an interim assessment would conclude the following:

1. Fermilab is a major contributor to the national neutron research effort, contributing more than half of the patient material to several of the national cooperative studies.

2. The Fermilab neutron beam has been highly reliable for delivering treatments on specific time schedules.

3. The Fermilab neutron beam is the most energetic and therefore the most penetrating neutron beam available in the world for patient treatment.

4. Fermilab facility personnel have been responsible for generation of the scientific justification and writing of the research proposals for nearly half the currently active clinical research studies using neutron beams with curative intent.

Specific evaluations have been completed in a number of areas. These include evaluations of specific types of cancers in specific locations, as well as evaluation of the effects of neutron treatment on normal tissues that are subjected to irradiation because of their proximity to the neoplasms. The national study of comparing neutron treatment with standard treatment for advanced cancers of the oral cavity and pharynx has now accrued over 200 patients. To date, neutron treatment has controlled cancer in more than half the patients, with the standard treatment having control rates of about 40%. This magnitude of improvement is encouraging, but further studies are being mounted to attempt even higher success rates. Patients referred for neutron treatment for tumors of the salivary glands have responded in a particularly gratifying way, with virtually 100% local control. The only patient who failed to achieve control was one with a very massive lesion.

Other tumors that have shown some response, but of considerably less magnitude, have been the primary tumors of the brain, cancer of the esophagus and of the pancreas. The esophageal and pancreatic tumors have been particularly suited for treatment at Fermilab because of their deep-seated location, requiring a penetrating neutron beam to deliver adequate dose.

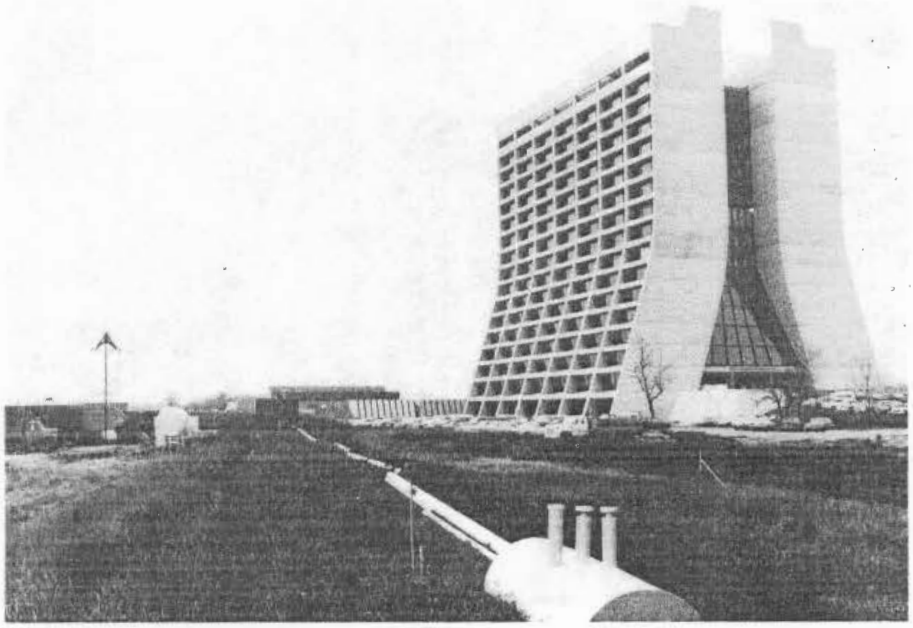
But the reactions and complications in the surrounding normal tissues have been sufficiently high and the control rate of the cancer sufficiently low that further evaluations of alternative treatment strategies are currently underway. These new research efforts will combine radiation-sensitizing agents in an effort to improve the therapeutic ratio of tumor injury to normal-tissue complications. Prostatic and uterine tumors have responded well and we hope to treat more patients who have these tumors.

Normal-tissue reactions were studied in 56 evaluable cases followed for at least one year after receiving neutron or "mixed beam" irradiation to total neutron doses of 20 Gy or more. Acute skin and mucosal reactions were classified as mild to moderate in all cases and all were considered clinically acceptable. The incidence of late reactions include severe subcutaneous fibrosis, trismus, and ulceration or necrosis of skin or gastrointestinal mucosa.

Eight out of 22 patients followed for a year or more after neutron doses in excess of 20 Gy showed significant late reactions. Late reactions were also observed in six out of twenty patients treated with a neutron boost of 7.5 Gy following 50 Gy of photons for intraoral cancer and 7 out of 11 "mixed-beam" cases receiving 9 to 11 neutron Gy with 45 to 50 photon Gy concurrently over a seven-week treatment period. Eight out of 17 patients treated with curative doses of neutrons following recurrence after radical photon therapy had excessively severe late effects.

In the neutron-only group, all patients were treated over a nominal six-week period, but the number of fractions ranged from 8 (once weekly) to 28 (four times weekly). A tentative isoeffect line (dose versus fractions) for cutaneous fibrosis could be drawn with an origin at 20 Gy and a slope of 0.04. A time-dose fractionation (TDF) analysis of the whole series suggested a median value, assuming an equivalency factor of 3.00 for our beam, of TDF = 120 ($\pm$10) for severe stromal fibrosis and associated complications.

The clinical research program has just recently undergone review by a group of peers for the National Cancer Institute. This group recommended for continued funding at a high priority level. New patients are being referred at a rate of 5 to 6 per week but the facility could handle a modest increase in patient referral without excessive strain. The continued clinical evaluation of neutron treatment in research laboratory settings is necessary as the nationally supported clinical neutron facilities will not be completed and available for patient accrual for at least 3 or 4 years.



Helium transfer line for the superconducting accelerator being installed above A sector.

(Photograph by Fermilab Photo Unit)

Drasko Jovanovic, new head of the Physics Department.
(Photograph by Fermilab Photo Unit)

NORMAN RAMSEY. . .

Norman Ramsey has returned to the presidency of Universities Research Association. He was elected by the URA board to succeed Prof. Milton White, who died in October.

T. B. W. KIRK. . .

T. B. W. Kirk has taken leave of the Neutrino Department to work on an experiment and Shigeki Mori will be head of the Neutrino Department until next April.