

Programs have also been designed to determine at which angles to aim the beam to give the optimum treatment to the tumor and the least radiation to normal tissues. The major result of the program is a three-dimensional distribution of dose in the patient, produced by the radiation fields as specified by the therapist.

With the use of computers in the treatment planning, not only can more information be obtained in a short period of time, but the information is highly refined, so that the radiation therapist can know precisely how much radiation he will deliver to any specific area.

A major recent development has been the extension of the computerized treatment planning carried out in individual centers to affiliated hospitals through the use of special interface equipment and telephone lines. The Memorial Computerized Treatment Planning Service is a pioneer effort in this respect and has been developed to make available to other hospitals the advantages of computer facilities and the associated treatment planning staff.

The need to extend the facilities of computerized treatment planning to radiation therapists in other hospitals which have limited treatment planning facilities has long been recognized. In the past, occasional treatment plans have been hand-carried by messenger from various other hospitals in the metropolitan area for computation at Memorial Hospital. In order to provide a more convenient and practical treatment planning service for collaborating hospitals, the present teletype-linked treatment planning service was developed and put into operation in March of 1967. The initial two collaborating hospitals were Mount Zion Tumor Institute, San Francisco, Calif., and St. Luke's Hospital, New York City, N.Y. The teletype treatment planning system was demonstrated at the American College of Radiology Computer Conference at the University of Missouri in April 1967. The input and output for treatment plans are transmitted via teletype over regular communication channels. On the average about 30 treatment plans per month are being computed by Memorial Hospital for each collaborating institution.

New programs are being continually developed, according to need. The latest programs will compute dose distributions for any number of nonconverging fields, for any number of nonconverging arc rotations, for any number of wedged fields, as well as for any combination of weighted fields of different field size. Provisions are also made to incorporate corrections for any number of inhomogeneities as well as irregularities in the patient's surface. The computer programs for internal sources are capable of producing dose distributions in any plane at any desired orientation with as many as 100 implanted sources.

Mr. CALLAHAN. Thank you, Dr. Laughlin.

Mr. Chairman, do you have a question of Dr. Laughlin?

Senator NELSON. Yes. I will have a question for you in just a moment, Doctor.

Are you still on, Doctor?

Dr. LAUGHLIN. Yes; right here.

Senator NELSON. Do I understand, then, that the radiologist can send to the computer the various computations, say, as to the size