economy, in a modern radiotherapy department. The results of a study conducted with all three systems for treatment planning of selected tumors located in various parts of the body will be presented, with emphasis on the relative merits of these systems including cost-effectiveness.

## (173) A COMPUTED TOMOGRAPHY-ENHANCED TREATMENT PLANNING SYSTEM

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Total body computed-tomography at Memorial Hospital is a valuable adjunct to both the clinical and physical aspects of radiation treatment planning. This has prompted the collaborative design and development of a new computerized treatment planning system which enhances the usefulness of CT transverse scans to the radiation therapy/physics team.

The system is composed of an Ohio-Nuclear off-line CT video system interfaced to a PDP-11/34. The software is built around the new treatment planning system developed and currently in use at Memorial Hospital. CT studies for radiation therapy patients are transferred to the system via floppy disc, magnetic tape, or less costly direct communication link. Analysis of transverse, sagittal, and coronal CT images by the therapist is carried out on this new system directly (CT-simulation), and the physicist can proceed to the dose distribution computations with no further physical data input required, the isodoses being displayed as a superimposition onto the original CT digital image(s).

The rationale for developing this interactive display/computation system, its use in a clinical setting, and its future potential will be discussed.

## (174) CHANGES IN TUMOR TISSUE OXYGENATION INDUCED BY MICROWAVE HYPERTHERMIA

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Tissue oxygen levels ($TpO_2$) were determined on subcutaneous tumors using a 100 ug tip floating oxygen microelectrode. $TpO_2$ and response to 100% $O_2$ breathing were recorded on a Grass Model 7 polygraph, as well as temperature changes both at tissue surface and at depth as measured with needle thermocouples. Hyperthermia was induced with microwave irradiation at a frequency of 2450 MHz delivered through a suitable applicator. Tumor temperature was maintained below 40°C for a test period of up to 2 hours.

There was an increase in $TpO_2$ that paralleled the raise in tumor temperature and was sustained throughout the test period. The elevation in $TpO_2$ induced by $O_2$ breathing was also potentiated by the hyperthermia. These findings are suggestive of increased tumor blood flow dependent on the temperature changes, while the possible influence of concentrated metabolic changes remains to be investigated.

## (175) THE SIGNIFICANCE OF FRACTIONATION REGIMENS IN COMBINED HYPERTHERMIA AND RADIATION USING A MURINE FIBROSARCOMA

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The aim of the present study is to evaluate the time-dose fractionation schedules in combined hyperthermia and radiation and to determine the optimum fractionation regimen following combined therapy. The time-dose dependence of a 1.0 $cm^3$ Methylcholanthrene induced fibrosarcoma (METH-A) carried in the thigh of male Balb/C mice treated with X-irradiation and concomitant local tumor hyperthermia was evaluated. Non-curative, fractionated radiation (total doses 1.8 - 4.2 K rads) was given alone or in combination with local hyperthermia (water bath immersion at 43.0$\pm$ 0.1$^{o}$C for 15 minutes), applied immediately after radiation. Treatment regimens consisted of four treatments separated by 1 - 4 days.

All treatment regimens of radiation plus hyperthermia had a greater tumor response as measured by surviving cell fractions, tumor growth delay and cure rate than comparable doses of radiation only. Furthermore, tumor response to radiation alone was both time and dose dependent, whereas tumor response to combined radiation and hyperthermia was less time dependent and more dependent on total dose of radiation delivered. The significance of these findings will be discussed in reference to the clinical application of combined treatment of radiation and hyperthermia.

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## (176) LYMPHOCYTOTOXICITY IN VITRO FOLLOWING HYPERTHERMIA TREATMENT OF RATS WITH MAMMARY CARCINOMA

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A hot water bath was used to locally heat a spontaneously metastasizing mammary carcinoma termed ME/H transplanted in the leg muscle of inbred Wistar/Furth rats. Heat was applied to Nembutal anesthetized rats so that the primary