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DAMAGE AND REPAIR IN SKIN FOLLOWING
EXPOSURE TO RADIOACTIVE PARTICLES

Progress Report

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MASTER

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phase of the project is scheduled to resume during the first week of April 1974.

The intervening period has been used to pursue some preliminary work and also to initiate some work which had been anticipated for later in the project periods.

A) Preliminary work:

Expansion of the swine herd

Our miniature swine were derived from the Harford-Labco Cross Variety, Battelle-Northwest Laboratory, Richland Washington. During the funding stringencies in the 1970-1973 period, our breeding herd was maintained at a minimum size, with surplus animals being used in a variety of investigative studies. With the advent of this contract, several gelts were added to the production stock. A number of shoats have now been used in preliminary studies, and it is anticipated that production will meet all needs of the projected studies under this contract.

Programming dosimetry codes for Temple computer facilities

One of the major operational difficulties in the "hot particle problem" (Science 183:834, 1 March 1974) involves computed dose distribution to the relatively small volume of tissue in the immediate vicinity of the particle. Using experience gained with studies on activated uranium microspheres, we have begun applying computational techniques to ⁹⁰Sr silicate microspheres of the type to be used in this project.

X-ray studies on mice and swine

Hairless mice and miniature swine are being used in studies designed

to evaluate the "area effect" in damage, repair and carcinogenesis.

Equivalent skin doses, delivered as uniform or sieve exposures are being compared.

B) Studies which had been anticipated for later project periods:

Solar UV exposure of hairless mice for later particle work

Hairless mice are being exposed to simulated sunlight 5 days per week for 10 weeks. With no further treatment, the UV exposure is designed to produce tumors in about half the animals by 20 weeks after the beginning of the study. Tumor yield and prevalence will be compared in mice with or without hot particle exposure of the UV-treated skin.

The relationship of trauma to skin neoplasia

Radioactive microspheres can induce profound changes in localized areas of skin, including neoplasia. Since physical trauma has sometimes been associated with skin tumorigenesis, it is important to assess the component of damage and wound healing in the process of radiation-induced neoplasia. The skin of mutant hairless (*hr/hr*) mice has proven to be susceptible to tumor induction by certain types of physical damage. Twelve mice were exposed to an FS20T12 Fluorescent "sun" lamp (12×10^4 j/m²) once, resulting in necrosis, sloughing, contraction and scarification. Over the subsequent 40 weeks, 20 tumors developed at the edges of healed burns on 6 mice. On 24 other hairless mice, the skin surrounding a sutured incision was frozen with CO₂ dry ice; 10 tumors developed on 7 mice. No tumors developed on an equal number of mice receiving either the incision or freezing treatment

alone. The tumors in both experiments were predominantly papillomas, in contrast to the carcinomas and sarcomas which follow low-level chronic radiation exposures. One significant finding during this project period, then, is that it may be possible to distinguish between components of the neoplastic process in hairless mouse skin on the basis of the type of tumors produced.

Studies on pig skin epidermal DNA replication and repair

Either UV radiation or chemical carcinogens can induce "unscheduled" DNA synthesis in epidermal cells of mouse or pig skin (Lieberman and Forbes, Nature New Biology 241:199, 1973). During this contract period we have also studied the feasibility of using *in vitro* uptake of ^3H -thymidine in skin for evaluation of tissue kinetics following radiation damage (report in preparation).

FIRST ANNUAL PROGRESS REPORT

CONTRACT NO. AT(11-1)-2366

ABSTRACT

During the first year of this project the work has centered on x-ray and UV studies which relate directly or indirectly to the hot particle problem. It has been found that one component of the neoplastic process in mouse skin (acute trauma) may be distinguished from another component (chronic radiation damage) on the basis of tumor type produced. Studies on cellular damage and repair, and on computer programs for tissue dose distributions are also under way. Most of this work was originally scheduled to begin during the second year of support; a study on the effects of ⁹⁰Sr silicate microsphere exposures of pig and mouse skin was to have begun during the first year. However, technical problems at Oak Ridge necessitated a postponement of this study, now scheduled to begin in April 1974.

ABSTRACT FORM — CONTRIBUTED PAPER

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"Induction of Skin Tumors By a Single Dose of UV Radiation or by Freezing."
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3322 N. Broad Street, Philadelphia, Pa. 19140, USA.

Radioactive microspheres can induce profound changes in localized areas of skin, including neoplasia. Since physical trauma has sometimes been associated with skin tumorigenesis, it is important to assess the component of damage and wound healing in the process of radiation-induced neoplasia. The skin of mutant hairless (*hr/hr*) mice has proven to be susceptible to tumor induction by certain types of physical damage. Twelve mice were exposed to an FS20T12 fluorescent "sun" lamp (12×10^4 j/m²) once, resulting in necrosis, sloughing, contraction and scarification. Over the subsequent 40 weeks, 20 tumors developed at the edges of healed burns on 6 mice. On 24 other hairless mice, the skin surrounding a sutured incision was frozen with CO₂ dry ice; 10 tumors developed on 7 mice. No tumors developed on an equal number of mice receiving either the incision or freezing treatment alone. The tumors in both experiments were predominantly papillomas, in contrast to the carcinomas and sarcomas which follow low-level chronic radiation exposures. Thus it may be possible to distinguish between components of the neoplastic process in hairless mouse skin on the basis of the type of tumors produced.

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