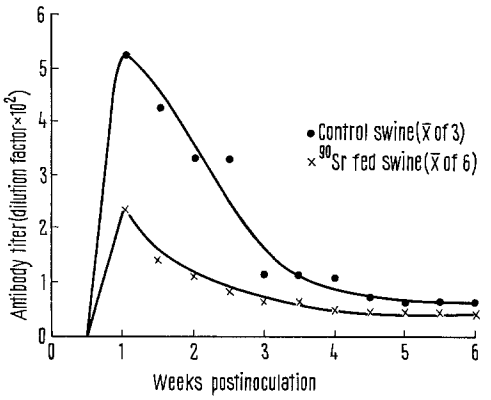
Immunosuppressive Effect of Chronic Strontium-90 Administration to Miniature Swine[1]

Pitman-Moore strain miniature swine have been fed daily doses of ^{90}Sr, through 3 generations extending over a period of 10 years, to determine the biologic effect of such a regimen and to ascertain the lowest dose level which would have no significant effect.

Strontium-90 is a beta-emitting radionuclide which is a bone seeker, competing with calcium for incorporation into the hydroxyapatite lattice of bone. Chronic exposure, such as by daily feeding of ^{90}Sr, results in a relatively uniform deposition of the radionuclide throughout the skeleton.

Leukemia has been the most frequently observed pathologic effect in these ^{90}Sr-exposed animals[2], although some osteosarcomas have also occurred[3]. Whether the leukemogen itself is considered to be an oncogenic virus or radiation, the immunologic surveillance system is often invoked in efforts to explain the leukemogenic process. This study was therefore conducted to determine the immunocompetence of miniature swine that had received chronic ^{90}Sr exposure.

Material and methods. The experimental protocol for our main ^{90}Sr exposure program has been previously described[4]. A separate group of Pitman-Moore miniature swine was selected for this study. The animals were 3 years of age; 6 were fed a daily dose of 625 μCi of ^{90}Sr and 3 served as controls. After the experimental animals had been fed ^{90}Sr for 10 months, they and the controls were given a single i.m. inoculation of 0.4 cm^3 of strain 19 *Brucella abortus* vaccine (Ft. Dodge Laboratories). Blood samples were taken biweekly for a period of 6 weeks following inoculation. Serum was separated and stored at − 60 °C until sampling was completed. The antibody titer was determined by the tube agglutination test using stained *B. abortus* antigen, and also using commercially titered antiserum (Sylvana Reagents) as a control.



Antibody response of Pitman-Moore miniature swine following *Brucella abortus* inoculation.

Results. Antibody response was not detected in either the inoculated or control swine until after the 4th day postinoculation. Maximum antibody titer was observed at 1 week postinoculation, at which time the level of specific antibody in the controls was more than twice that in the ^{90}Sr-exposed animals (Figure). This difference persisted throughout the observation period. By the 10th day postinoculation the titer was decreasing in both groups of animals, leveling off after about 28 days, at which time the titer of the controls still exceeded that of the ^{90}Sr-treated swine. The level of antibody response exhibited by the control swine is similar to that previously reported[5].

At the time of *B. abortus* inoculation there was no significant deviation from the normal hemogram in these ^{90}Sr-fed swine. Their clinical condition appeared normal, and at necropsy examination at the termination of this study, there was no significant histopathology.

Discussion. It was demonstrated in this experiment that prolonged ^{90}Sr exposure results in a significant immunodepression. Since the marrow is the hematopoietic tissue receiving the greatest radiation dose, we suspect that the defect in antibody response is a result of irradiating sensitive immunocompetent cells in this site. Both myeloid and lymphoid neoplasms have been produced in miniature swine receiving chronic ^{90}Sr exposure, possibly indicating that this radiation damage affects the pluripotent stem cell population in the marrow.

What role the chronic immunosuppression plays in the leukemogenic process has not been determined. Latent virus has been isolated from the leukemic swine of this study, but not from the control animals. Possibly the potentially oncogenic latent virus is allowed to express its effect when the antibody producing system is suppressed.

Zusammenfassung. Antikörperproduktion in Schweinen, die einer chronischen internen Strontium^{90}-Bestrahlung ausgesetzt waren.

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Absence of Haemolytic Effects of L-DOPA on Transfused G6PD-Deficient Erythrocytes

In vitro incubation of various concentrations of L-DOPA results in significant loss of GSH from G6PD-deficient and not from normal red cells[1]. Kosower and Kosower also suggest the possibility that DOPA and cathecholamines may contribute to the destruction of GSH under physiological conditions in G6PD-deficient individuals. These substances may be responsible, at least in part, for the shortened survival of G6PD-deficient red cells found in affected individuals not subjected to the action of oxidating drugs[2]. L-DOPA is used in neurology for the treatment of Parkinson's disease[3]. If the drug had some haemolytic effects it would be highly dangerous to