

crease in the number of antibodies. A sufficient number of these bodies, however, were present during the May determination to merit the designation of 3 plus (+++) with the usual complement fixation technique.

The case of Rabbit A, immunized with 0.5 gm. of protein showing in its blood the presence of complement fixing antibodies five months after immunization, is of significance inasmuch as it revives the old disputed question as to the nature of the complement fixing antibody. The widely accepted view that this antibody is an indication of the presence of an active antigenic manifestation in the body as differentiated from the agglutinin, for example, which is a true antibody, is brought to question; since one would have to assume that some of this small quantity of protein is present in the animal in some form, after 5 months—a quite unlikely condition.

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Influence of radium and x-rays on the frog's leucocytes.

By **M. M. STURGES** and **ISAAC LEVIN.**

*[From the Department of Cancer Research, Montefiore Hospital,
New York.]*

The white blood corpuscles are the most sensitive cells to the action of radium and x-rays. The senior writer has indicated in his previous publications that this action differs specifically for the various types of the white blood cells. This "selective" biological action of the rays goes even beyond the apparent structural differences of the cells. The rays for instance destroy rapidly the lymphocytes of lymphatic leukemia, while they have a comparatively slight effect on the lymphocytes in conditions of inflammatory leucocytosis. As a general rule the result of the action of radium and x-rays on the normal blood consists in the diminution of the number of lymphocytes and a relative increase in the number of the polymorphonuclear leucocytes. The other types of leucocytes usually remain unaffected.

The real significance of this phenomenon will remain obscured until a clearer insight is gained into the derivation and the comparative functional significance of the two types of white blood cells.

The numerical proportion of the lymphocytes and the polymorphonuclear leucocytes differs in the various animal species and it is therefore of great importance for the ultimate elucidation of the whole problem to test the action of the rays on different species of animals.

The present investigation consisted in subjecting to the action of radium and x-rays normal frogs and also frogs in whom a change in the white blood cells was induced by a preliminary injection of yeast.

X-raying of Normal Frogs.—The method consisted in taking a total and differential blood count of the animal before the raying. The whole animal was then x-rayed (45 minutes, Coolidge tube, 7 ma. 9-inch spark gap, 5-inch focal distance) and blood counts taken at various intervals for four days. The results obtained were as follows. The total leucocyte count showed practically no difference from the normal count before radiation, and the same holds true for the other series of experiments. The differential count showed a marked change in the numerical relationship between the polymorphonuclears and lymphocytes, while the number of the eosinophiles and transitionals remained practically stationary. To cite an instance,—2 eosin., 14 poly., 84 lympho. changed into 2 eosin., 70 poly., 28 lympho.

This change was most marked 24 hours after radiation, and the blood usually became normal after about four days.

Radiumization of Normal Frogs.—The method consisted in the introduction into dorsal lymphsac of a frog of a minute capillary glass tube about 4 mm. long containing from 1.0 to 0.6 millicuries of radium emanation. This method produces a slow and continuous action of the rays of radium on the organization of the animal. The results obtained on the blood were quite analogous to those produced by the x-rays. The important difference, however, consisted in the fact that the numerical difference between the lymphocytes was most pronounced only about three days after the insertion of the radium emanation capillary. For instance, the

normal blood showed 1 eosin., 1 poly., 98 lympho.: 24 hours after radiumization, 2 eosin., 34 poly., 64 lympho., and 72 hours after radiumization 1 eosin., 85 poly., 13 lympho.

Radiumization of Yeasted Frogs.—The experiments consisted in the injection of an emulsion of yeast into a normal frog, and this was followed 24 hours later by x-raying the animal or an insertion of a radium emanation capillary. The injection of yeast is followed by a change in the blood of a frog similar to the one induced by the x-rays or radium, and the change is most marked 24 hours after the injection and continues for a few days. For instance, the normal blood showed 0 eosin., 18 poly., 82 lympho. 23 hours after yeasting, 1 eosin., 73 poly., 26 lympho. Now the remarkable phenomenon observed in this series consisted in the fact that neither the x-rays nor the radium produced any further noticeable change in the numerical relationship between the lymphocytes and the polymorphonuclear leucocytes, or at the most a very slight additional decrease of lymphocytes. To cite an instance: the normal blood showed 2 eosin., 22 poly., 76 lympho.: 17 hours after yeasting, 0 eosin., 60 poly., 49 lympho. The animal was then x-rayed and immediately after showed 3 eosin., 68 poly., 29 lympho.: 24 hours later, 1 eosin., 80 poly., 19 lympho.

The analysis of the experiments shows that in the frog, as in the human, the action of the rays consists mainly in the diminution of the relative number of lymphocytes. However in the normal frog it does not seem to be accompanied by a noticeable change in the total blood count. The radiations seem to produce a different effect on lymphocytes of a normal frog from the one produced on the lymphocytes of a yeasted frog. This phenomenon is also analogous to effects which are related in the beginning of the paper as occurring in the human.