EFFECT OF EXTERNAL γ-IRRADIATION ON ANTIBODY-PRODUCING CELLS BY JERNE'S METHOD

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The effect of external irradiation on antibody formation has received the closest study. Irradiation is known to cause severe damage to this process [1, 3, 5, 8], yet at the same time investigations at the cellular level, studying quantitative relationships, have only just started [2, 4, 7]. The method suggested by Jerne [6] for detecting cells producing antibodies and for the direct quantitative analysis of these cells is of particular interest.

In the present investigation Jerne's method was used to study the changes in the number of antibody-producing cells caused by external γ-ray irradiation.

EXPERIMENTAL METHOD AND RESULTS

Experiments were carried out on 150 male CBA mice weighing 23-25g. Washed sheep's erythrocytes were used as antigen and were injected intraperitoneally in a single dose (1 ml of a 2% suspension). Irradiation took place on the 3rd day after immunization, in doses of 330 and 660 R. Parallel with the determination of the number of antibody-producing cells, the antibody titers in the blood of the mice were investigated.

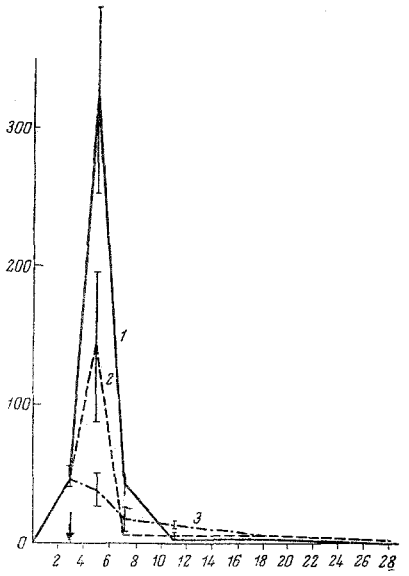

Fig. 1. Effect of irradiation on number of antibody-forming cells in the spleen of CBA mice immunized with sheep's erythrocytes. 1) Control; 2) irradiated in a dose of 330 R; 3) irradiated in a dose of 660 R. Ordinate—number of antibody-forming cells per million spleen cells; abscissa—days after immunization. The arrow indicates the time of irradiation.

The results showed (see figure) that in normal conditions the number of antibody-forming cells 3 days after immunization was 46 ± 5 per million spleen cells. On the following days the number of these cells rose, reaching 321 ± 66 on the 5th day, but then fell to 48 ± 8 on the 7th day, and 3 weeks after immunization only one or two could be counted.

Irradiation in a dose of 330 R reduced the number of antibody-synthesizing cells several times, so that on the 5th day it was 142 ± 52 per million spleen cells, evidently on account of death and disintegration of these cells, although the character of the curve of the rise and fall in their number remained the same in principle as normally.

Irradiation in a dose of 660 R caused an even more marked decrease in the number of antibody-producing cells, so that the curve of the number of cells did not show an increase on the 5th day after immunization (39 ± 12). Instead, it fell steadily and joined the analogous curve for the mice irradiated in a dose of 330 R on the 18th day.

Investigations of the hemolysin titer in the blood showed that irradiation in high doses of γ-rays on the 3rd day after immunization had practically no effect on the blood level of these antibodies. No antibody-forming cells were found in the spleen and no antibodies in the blood of all the unimmunized animals of the control groups (50 animals).

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The most interesting result was that, when irradiation was carried out on the 3rd day after one-stage immunization, the preservation of high titers of hemolysins in the blood was coupled with a marked fall in the number of antibody-synthesizing cells in the spleen. When irradiation was in a dose of 330 R, their number on the 5th day after immunization was 45% of normal, and when in a dose of 660 R, their number was only 12% of normal. This may be because the antibody-producing cells injured by radiation suceeded in liberating the normal amount of antibodies before they died, and these entered the blood stream. Later these cells died more quickly than in normal conditions, and were not detected by Jerne's method. Another possibility is that when these cells died additional antibodies entered the blood stream, and for this reason the blood antibody titer of the experimental animals remained within normal limits.

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