# EXPERIMENTAL STUDY OF THE EFFECT OF ULTRAVIOLET IRRADIATION OF BLOOD IN VIVO

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The history of the use of ultraviolet irradiation of blood (UVIB) in clinical practice goes back more than 60 years [7]. However, there is as yet no single concept which could explain all the manifestations of the beneficial action of UVIB. Moreover, the actual component of blood (cells, proteins, biologically active substances) on which ultraviolet light (UVL) acts mainly has not been identified.

The aim of this investigation was to determine the pathway of the effect of UVL through its action mainly on blood cells or serum.

## EXPERIMENTAL METHOD

To determine the predominant level at which UVL acts (cellular, humoral) an investigation was carried out to compare the results of irradiation of whole blood, serum, and a cell suspension. Inbred male CBA mice weighing 25-28 g were used. The mice were immunized intraperitoneally with sheep's red blood cells (SRBC) in a dose of $5 \cdot 10$ cells per mouse. After 1 h, the three groups of sensitized mice were given an intravenous injection of whole blood, blood cells, and serum, which had been irradiated with UVL. The components were injected intravenously simultaneously in all groups in a dilution corresponding to 1 ml/kg body weight. Blood was separated into cells and serum as follows. Whole blood obtained from intact syngeneic mice, with the addition of 1000 U heparin, was separated by centrifugation into cells and plasma. The cell suspension thus obtained, after washing three times in physiological saline, was adjusted to a concentration corresponding to that of cells in whole blood. The biological activity of the UV-irradiated serum was assessed from its effect on proliferation of antibody-forming cells (AFC), which was determined by the method of direct local hemagglutination in gel [6], 4 days after immunization. The series consisted of three experiments, with ten mice in each group. As the control the same quantity of blood components, not subjected to UV irradiation, was injected. The significance of the results was determined by Student's parametric test. Calculations were done on a PC/AT personal computer, using the "STATGRAPHICS" program for statistical analysis (the 2.0 version).

## EXPERIMENTAL RESULTS

The experiments showed that UV irradiation of different blood components stimulates the proliferation of AFC differently (Table 1). After injection of UV-irradiated serum the number of AFC in the spleen was doubled. A somewhat lower degree of activation of proliferation was obtained by UV irradiation of whole blood, namely by 1.35 times.

If a cell suspension was irradiated, no appreciable increase in the number of AFC took place.

It can be concluded from these results that UVIB acts on the body mainly through stimulation of biologically active substances located in the serum, and not by any direct effect on the blood cells. Admittedly, several workers nevertheless have noted the ability of UV light to induce destruction of the outer layer of the membrane of the erythrocytes and lymphocytes, and also to modify the activity of some membrane receptors and antigenic determinants of cells [2-4]. In our

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TABLE 1. Dependence of Number of AFC in Mouse Spleen on UV Irradiation of Blood and Its Components

| Experimental conditions | Number of AFC (M ± m) | | |
|---|---|---|---|
| | blood (n = 60) | cell suspension (n = 60) | serum (n = 60) |
| Control | 69353.33±6603.715 | 73934.66±7027.834 | 55290.4±8746.05 |
| Experiment | 94403.66±18155.04 | 83471.2±3616.683 | 112682±9218.582 |
| | $p<0.01$ | | $p<0.01$ |

view, the extremely small number of cells which are exposed to the influence of UV light (fewer than 5% of the total number of cells is irradiated), cannot maintain these marked and diverse effects which have been described in the literature. At the same time, biologically active substances can modify the response of the body, when "working" in microscopic quantities.

UV light is known to have a photochemical action on adrenalin and glutathione of progesterone [5]. Stimulation of their activity can be explained by a change in the stereochemical form of the molecules, jointly with photolysis [8], or a switch to another energy level due to the addition of quanta of light energy.

The immunostimulating and other effects of UVIB are evidently realized through activation of the reticuloendothelial system, which consists of stimulation of resident macrophages predominantly through humoral factors, in agreement with the results of this investigation.

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