

SENSITIZING PROPERTIES OF THE PARENCHYMATOUS ORGANS OF KITTENS AND WHITE MICE INFECTED WITH DYSENTERY BACILLI AND STREPTOCOCCI

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Information regarding the sensitizing properties of the internal organs and the formation of autoantigens and corresponding autoantibodies in certain diseases and pathological states may be found in papers by several authors [1-6].

In the present communication we report the results of investigations, carried out jointly with S. A. Ignat'eva, E. D. Zhuravleva, N. K. Bondarenko and V. P. Morozova, and concerned with the study of the sensitizing properties of the parenchymatous organs of kittens and white mice infected with dysentery bacilli and streptococci.

EXPERIMENTAL METHOD

The experiments were conducted by the method published previously [2]. As a supplementary procedure the final desensitization was also performed in relation to a culture of the infecting agent, which was also injected into the heart in a dose of $1-2 \times 10^9$ bacterial cells in a volume of 1 ml. In no case (in more than 100 experiments) did guinea pigs, sensitized with infected organs, react to a culture of dysentery bacilli and streptococci.

The only exception was formed by experiments with the organs of mice inoculated with brucellosis and tularemia vaccines, in which a shock reaction was observed to injection of the latter. Desensitization with saline extracts of organs in the experiments to be described was carried out in two stages: a dose of 2 ml was given subcutaneously, followed 24 hours later by doses of 0.2 to 0.8 ml into the heart. In order to render the animals completely desensitized, two or, more rarely, three injections had to be given. We give below an extract from the records of experiment no. 3 on June 20, 1958.

Guinea pig no. 7. On June 20, 1958, 2 ml of a saline extract (19.2% protein) of the kidneys of a kitten, killed with ether on the seventh day after infection with *Shigella flexneri*, was injected subcutaneously.

July 10, 1958. 10 A. M. 2 ml of a saline extract of the kidneys of a healthy kitten injected. 12 noon. Reaction +.

July 11, 1958. 0.2 ml of a saline extract from the kidneys of a healthy kitten injected into the heart. No reaction. 12 noon. 0.8 ml of the same material injected into the heart. No reaction. 2 P. M. 2×10^9 bacterial cells (1 ml) of a 24-hour culture of *Shigella flexneri* on agar injected into the heart. No reaction. 4 P. M. 0.8 ml of a saline extract of the kidneys of a kitten infected with dysentery and killed with ether on the seventh day, injected into the heart. 4:12 P. M. Reaction ++++.

Necropsy: emphysema of the lungs; small quantity of serous fluid in the pericardial cavity; intestinal mucosa hyperemic.

Very often after the injection of 0.2 ml of the desensitizing material into the heart a reaction of + or ++, or even +++, was observed. In this case the routine dose was 0.3 or 0.4 ml, and the last dose 0.6 or 0.8 ml.

EXPERIMENTAL RESULTS

The results of the experiments with the organs of white mice and kittens infected with dysentery bacilli are shown in Table 1, in which the concluding anaphylactic reaction is indicated.

It will be seen from Table 1 that of the 18 guinea pigs sensitized to the liver of infected mice and kittens 16 reacted to the assaulting dose by a varying degree of shock, including 5 guinea pigs whose reaction was ++++; correspondingly, of the 12 guinea pigs sensitized to pathological spleen, a shock reaction was given by 9, in 4 of which its intensity was ++++; finally, of the 13 guinea pigs sensitized to tissue from the kidneys, a shock reaction was given by 10, including 4 to the degree ++++. Altogether, of 43 experimental guinea pigs, 35 reacted by shock and 8 gave a negative reaction.

TABLE 1. Results of Experiments with Organs of Mice and Kittens Infected with *Shigella flexneri*

Sensitizing material	No. of guinea pigs		Concluding reaction to sensitizing material and number of guinea pigs				
	Controls	Desensitized	-	+	++	+++	++++
Liver of mice: 24 hours after infection		4	1	2	0	1	0
healthy		4	1	3	0	0	0
	3	0	3	0	0	0	0
Liver of mice: 5 days after infection		7	0	2	1	3	1
healthy		5	2	3	0	0	0
	5	0	5	0	0	0	0
Spleen of mice: 5 days after infection		5	1	0	1	0	3
healthy		6	5	1	0	0	0
	5	0	5	0	0	0	0
Kidney of mice: 5 days after infection		6	0	4	0	0	2
healthy		4	1	3	0	0	0
	6	0	6	0	0	0	0
Liver of kittens: 7 days after infection		7	1	1	1	0	4
healthy		3	1	2	0	0	0
	3	0	3	0	0	0	0
Spleen of kittens: 7 days after infection		7	2	3	0	1	1
healthy		3	1	1	0	1	0
	3	0	3	0	0	0	0

(Concluded on next page)

Legend: + scratches nose with paws; ++ the same plus sneezing and shaggy fur; +++ the same plus cough, all manifestations more pronounced; ++++ excitation, jumping about, fits, death; minus - these manifestations absent; 0 - none of the guinea pigs reacted; numbers - number of guinea pigs.

TABLE 1 (Concluded).

Sensitizing material	No. of guinea pigs		Concluding reaction to sensitizing material and number of guinea pigs				
	Controls	Desensitized	-	+	++	+++	++++
Kidney of kittens:							
7 days after infection		7	3	1	0	1	2
healthy		5	3	1	0	0	1
	3	0	3	0	0	0	0

Legend: + scratches nose with paws; ++ the same plus sneezing and shaggy fur; +++ the same plus cough, all manifestations more pronounced; ++++ excitation, jumping about, fits, death; minus—these manifestations absent; 0—none of the guinea pigs reacted; numbers — number of guinea pigs.

The analysis of corresponding experiments with saline extracts of organs of healthy mice and kittens showed that, of 30 sensitized guinea pigs, in this case 14 gave a shock reaction of intensity +, one gave a reaction of +++ and one, of ++++; in 14 guinea pigs the reaction was negative. All control animals gave a negative reaction.

It was considered to be of interest to study the analogous reaction in kittens treated for dysentery by chloramphenicol and phthalyl sulfathiazole. The animals were sacrificed on the 11th day after the beginning of treatment or on the 13th day after infection. Cultures from blood and tissue of the internal organs were negative in all cases.

Altogether, of 20 guinea pigs sensitized to extracts of the liver, spleen and kidneys of the treated kittens, 5 gave a shock reaction to the final injection of extract of the tissue of the original organ, in 4 of which the intensity was +++ and in one it was +; 15 guinea pigs gave no reaction. Of 10 guinea pigs sensitized to the organs of healthy kittens, 6 animals gave reactions of intensity ++++, +++ and +; in 4 animals there was no reaction. The control guinea pigs did not react to injection of the material.

The results of experiments* with the organs of white mice infected with streptococci and with organs of healthy animals are shown in Table 2.

Of 4 guinea pigs sensitized to "diseased" liver, all 4 reacted + to the concluding injection of extract of the same organ; in an analogous experiment with "healthy" liver, one of 4 guinea pigs reacted +. Of 6 guinea pigs sensitized to a suspension of pathological spleens, obtained from mice 5–6 hours after infection, all 6 animals reacted to the concluding injection of material from these organs, one in an intensity of ++++, 3 of +++ and 2 of ++; the corresponding experiment with the spleens of noninfected mice showed that in this case 5 of the 6 sensitized guinea pigs gave a shock reaction,

one in an intensity of +++, 2 of ++ and 2 of +.

Extracts of the spleens of mice 20 hours after infection with streptococci possessed no sensitizing properties; the proteins of "healthy" organs sensitized the animals and, after desensitization with proteins from the pathological spleens, they gave a shock reaction. Tissue from kidneys of the mice, 48 hours after infection, acquired sensitizing properties.

Experiments with the organs of white mice inoculated with living tularemia and brucellosis vaccines gave negative results: under the influence of these inoculations the internal organs of the animals did not acquire sensitizing properties.

Experiments with brucellosis vaccine were carried out on 27 guinea pigs, and those with tularemia vaccine on 12.

How may the results obtained be explained? It may be assumed that the organs acquired sensitizing properties as a result of the inflammatory reaction of the animal body, leading to changes in the proteins and cells of the internal organs.

In relation to the pathogenesis of glomerulonephritis and rheumatic carditis, Cavelti [3] proved that as a result of contact between bacteria and the products of their vital activity and the tissues thereby affected, the latter acquire extraordinary properties, including those of autoimmunization.

L. A. Il'ina and R. V. Petrov [4] reported that in acute radiation sickness, terminating in death of animals, processes of protein synthesis are disturbed.

The mechanism of development of sensitizing properties in the internal organs that we studied when infected with dysentery bacilli and streptococci is not yet quite clear. There is reason to believe, however, that the processes which we studied are accompanied by the formation of autoantigens. E. D. Zhuravleva,

* Carried out in conjunction with V. P. Morozova.

TABLE 2. Results of Experiments with Organs of Mice Infected with Streptococci

Sensitizing material	No. of guinea pigs		Concluding reaction to sensitizing material and number of guinea pigs				
	Controls	Desensitized	-	+	++	+++	++++
Liver of mice: 5 days after infection		4	0	4	0	0	0
healthy		4	3	1	0	0	0
	3	0	3	0	0	0	0
Spleen of mice: 5-6 days after infection		6	0	0	2	3	1
healthy		6	1	2	2	1	0
	6	0	6	0	0	0	0
Spleen of mice: 20 hours after infection		8	8	0	0	0	0
healthy		4	1	2	1	0	0
	3	0	3	0	0	0	0
Kidney of mice: 48 hours after infection		2	0	0	1	0	1
healthy		2	0	1	0	0	1
	3	0	3	0	0	0	0

Note : Legend as in Table 1.

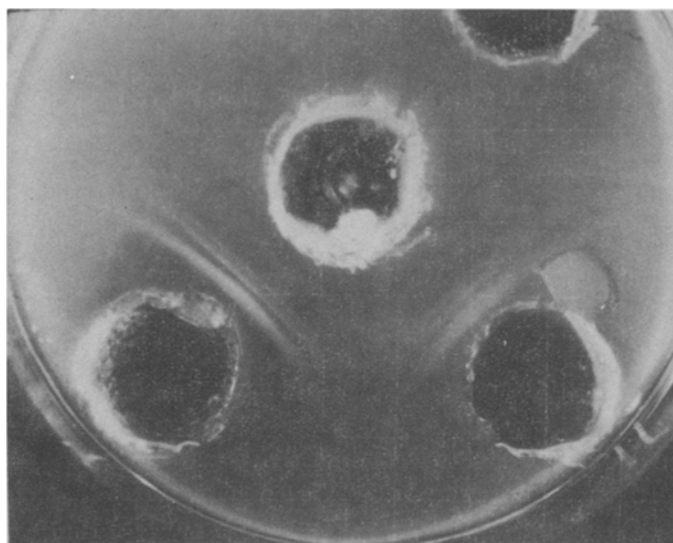


Fig. 1. Precipitation reaction in jelly with extract of the kidneys of kittens suffering from dysentery. Two foreign antigens are seen.

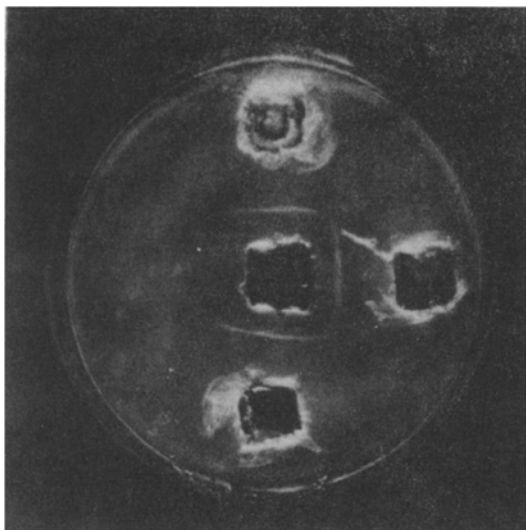


Fig. 2. Precipitation reaction in jelly with extract of the liver of kittens suffering from dysentery. One foreign antigen is seen.

for instance, using P. N. Kosyakov's technique, prepared a serum against the liver and kidney proteins of healthy kittens and of kittens suffering from dysentery. Antibodies to the causative organism of dysentery were extracted from the sera against the pathologically changed organs. The precipitation reaction in jelly with anti-sera against "healthy" kidney gave one line of precipitate, and against "healthy" liver two, demonstrating the presence in these organs of one or two (liver) antigens.

The analogous reaction with serum against "dysenteric" liver and kidneys and with their extracts gave three lines of precipitate (Figs. 1 and 2).

By means of the precipitation reaction in jelly, the presence of two foreign antigens in pathological kidneys and of one in liver was thus demonstrated.

SUMMARY

The parenchymatous organs of kittens and white mice acquire specific sensitizing properties during the process of experimental infection of these animals with the causative agents of dysentery and streptococci. Vaccination of white mice against tularemia and brucellosis is not associated with the above phenomena.

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†Original Russian pagination. See C. B. translation.