of the immune response, in particular, to thymus-dependent antigen. PS B-646 alters the enzyme balance of macrophages and neutrophils, acting selectively on the accumulation of different enzymes in the cells and on permeability of the cell membranes. The mechanism of action of PS B-646 suggests that its further study with a view to stimulation of cellular defensive reactions would serve a useful purpose.

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THOMSEN ANTIGEN IN NORMAL HUMAN TISSUES AND TUMORS

M. S. Berdinskikh, R. P. Pavlyuchenkova, A. S. Kiseleva, A. M. Kulakova, and Academician P. N. Kosyakov*

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KEY WORDS: Thomsen antigen; human malignant tumors; fibrocystic mastopathy; fibroadenoma; specific adsorption method; hemagglutination test.

The Thomsen–Friedenreich antigen was first discovered in human erythrocytes [8, 9, 13]. The presence of this antigen in human tissues has not been adequately studied. However, it is known not to be present in normal tissues, but to appear in them *de novo* as a result of the action of viral and bacterial neuraminidase on the mucoprotein receptors of the cell, i.e., as a result of removal of N-acetylneuraminic acid from the substrate [2-4, 7, 8, 13, 14]. Thomsen antigen is formed by inactivation of group-specific antigens of the MN system. This antigen likewise has not been found in human tumors by the use of heteroimmune (rabbit) sera [4]. However, the use of sera of human origin, i.e., of isosera, gave different results [10-12]. Springer et al. [10-12], using human sera containing specific antibodies against Thomsen antigen, showed that this antigen is present in carcinomas of the breast and gastrointestinal tract. Meanwhile they could not find this antigen in benign tumors (fibroadenoma of the breast, fibrocystic mastopathy). The authors cited suggest that the appearance of Thomsen antigen in human carcinomas is evidence either of the imperfect biosynthesis of antigens in malignant tumor cells or of increased degradation of normal antigenic components of the cell membrane, which distinguishes cancerous from normal tissues.

*Academy of Medical Sciences of the USSR.

Laboratory of Immunology, D. I. Ivanovskii Institute of Virology, Academy of Medical Sciences of the USSR, Moscow.

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TABLE 1. Serological Activity of Neoplastic and Normal Human Tissues

Test object	Titer of specific anti-T serum in HT*		
	before adsorption	after adsorption by †	
		tumor tissue	normal tissue
Carcinoma of the lung	1 : 32		
patient № 1, 15		1 : 2	1 : 16
" № 2, 18		1 : 4	1 : 16
" № 3		1 : 8	1 : 32
" № 6		0	1 : 16
Carcinoma of large intestine			
patient № 4, 11		1 : 2	1 : 16
" № 20		0	1 : 32
Carcinoma of rectum			
patient № 8		0	1 : 16
" № 16		1 : 2	1 : 16
Carcinoma of stomach	1 : 16		
patient № 7, 10		1 : 2	1 : 16
" № 17		1 : 2	1 : 8
" № 21		0	1 : 16
Fibrocystic mastopathy			
patient № 5		1 : 16	—
" № 19		1 : 8	—
Fibroadenoma of breast			
patient № 13, 14		1 : 16	—
" № 9, 12		1 : 16	—

*Dilution of specific serum giving agglutination rated at + was taken to be its titer.
†Tumor tissue or normal tissue of the same organ, taken from the same patient.

TABLE 2. Content of Antibodies against Thomsen Antigen in Sera of Patients with Tumors and Healthy Blood Donors

Group of subjects	Number of subjects tested	Number with undermentioned titer of T-agglutinins								Mean antibody titer
		1:1	1:2	1:4	1:8	1:16	1:32	1:64	1:128	
Patients with cancer	12	1	1	—	4	3	3	—	—	1 : 14,8
Patients with benign tumors	6	—	—	—	—	1	—	3	2	1 : 77,3
Normal subjects	58	—	—	—	3	9	18	17	11	1 : 55,8

Considering the importance and particular interest of this problem, it was decided to continue its study with an investigation for which, like Springer et al., we used sera of isogeneic origin.

EXPERIMENTAL METHOD

The test objects were tumors (material obtained at operations) from 15 patients with carcinoma of the lung (six), stomach (four), large intestine (three), and rectum (two). Normal tissues of the same organ, removed from the same patient during the operation from a place far removed from the tumor, were investigated as the control. Benign tumors from six patients also were tested: fibroadenoma of the breast (four) and fibrocystic mastopathy (two). Before use in the experiment the tissues were homogenized by freezing and thawing five times and were washed. The presence or absence of Thomsen antigen was judged from the results of specific adsorption experiments. Sera from healthy blood donors of group IV (AB), containing anti-T agglutinins, were used for this purpose. The tissue residue and serum were mixed in the ratio of 1:1, the mixture was allowed to stand at room temperature for 30 min, after which it was centrifuged. Adsorbed serum was titrated in the hemagglutination test (HT). Human blood

group I (0) erythrocytes, treated with neuraminidase from a noncholera vibrio (strain Nag, obtained from the Gor'kii Research Institute of Epidemiology and Microbiology by the method in [6]), were used as test erythrocytes. The titer of antibodies against Thomsen antigen in the sera of the subjects tested was determined by the HT.

EXPERIMENTAL RESULTS

Table 1 shows that the titer of specific antiserum against Thomsen antigen (anti-T) before adsorption was 1:16-1:32. Cells of malignant tumors, such as carcinoma of the lung (Table 1), specifically bound anti-T agglutinins. By contrast, normal lung tissue taken from the same patient did not have this property. Similar results also were obtained when testing carcinomas of the gastrointestinal tract (stomach, large intestine, rectum). The serological activity of the various malignant tumors differed, but all lowered the titer of specific anti-T serum after adsorption by 4-32 times. Normal tissues of these same organs did not bind anti-T antibodies. The results of these experiments indicate that human cancer cells contain Thomsen antigen, whereas this antigen is not present in normal tissues of the same organ.

Cells of malignant tumors (Table 1), like normal human tissues, did not react with anti-T serum, i.e., they did not contain Thomsen antigen. The results of these experiments agree with the data of Springer et al. [10-12]. However, those workers used genetically heterogeneous material for their study, whereas in the present experiments tissues obtained from the same patient were tested. Moreover, the present investigations showed that Thomsen antigen is present not only in carcinomas of the breast and gastrointestinal tract [10-12], but also in cancer in other situations (lung).

Isogeneic sera as a rule are more specific and they therefore enable the finer antigenic structures of cells and tissues to be detected. This applies, for example, to antigens of the MN and rhesus systems. Thomsen antigen, as the experiments showed, is no exception in this respect. The experimental results broaden our ideas of the antigenic composition of human tumors and demonstrate that Thomsen antigen is a marker for malignant neoplasms.

The authors cited above [10-12] also reported that the titer of antibodies against Thomsen antigen in cancer patients is lower than in normal blood donors or in patients with benign tumors. The results of the present experiments (Table 2) confirm these observations.

The question of the causes of the reduction in titer of antibodies against Thomsen antigen in cancer patients, however, requires special study. In the opinion of the authors cited above, Thomsen antigen discovered in tumors binds the corresponding antibodies circulating in the patient and thus lowers their concentration. However, we know [5] that under the influence of malignant disease the titer of other normal antibodies, for example iso- and heterohemagglutinins, also shows a marked decline, and this may be evidence of depression of the functions of the patient's immune system as a whole.

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