IMMUNOLOGY AND MICROBIOLOGY

Asymmetry in Cerebral Hemispheres and Thymus Lobes during Realization of Humoral Immune Response in Mice

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We studied the role of functional asymmetry in mouse brain and thymus in the realization of humoral immune response. It was concluded that not only nervous system asymmetry, but also immune system asymmetry and the relationship between the cerebral hemispheres and cells of the right and left thymus lobes play an important role in the regulation of immune response.

Key Words: *nervous system asymmetry; immune system asymmetry; humoral immune response*

Studies of asymmetry in the cerebral hemispheres revealed structural, sensory, motor, molecular, and biological differences [7-9]. Cerebral asymmetry determines normal functioning of the nervous system, ontogeny, sexual dimorphism, intellectual abilities, and adaptation to extreme factors [7]. It was reported that cerebral hemispheres play different roles in the regulation of the immune response (IR) [1,6,9,10]. Functional asymmetry is characteristic of not only the nervous, but also the immune system [3-5]. However, its role in the regulation of IR remains unknown. Here we studied the dependence of humoral IR on motor asymmetry and the involvement of cells in contralateral thymus lobes in the regulation of IR.

MATERIALS AND METHODS

Experiments were performed on male (CBA×C57Bl/6)F_1 mice obtained from the Tomsk nursery, kept in a vivarium in plastic cages (10 animals in each), and receiving *ad libitum* food and water. Motor asymmetry was assessed by paw preference in taking food (3 tests at 3-day intervals). Further experiments were performed on mice displaying the same motor asymmetry in all tasks (right- and left-pawed animals). Since paw preference indicated dominance of the contralateral cerebral hemisphere, the animals were designated as left- and right-hemisphered. Two-month-old mice were thymectomized to evaluate the role of cells in contralateral thymus lobes in IR. Five weeks after surgery, the animals were intravenously injected with thymocytes from the right or left thymus lobes of syngeneic donors (10^7 cells/mouse). These mice were immunized with sheep erythrocytes (SE) 10 days after thymocyte administration. Antibody-producing cells (APC) in the spleen were counted by the method of Cunningham 4 days after immunization. The results were analyzed by Student's *t* test for independent samples.

RESULTS

Left- and right-hemisphered animals were immunized with SE to evaluate the role of cerebral hemispheres in humoral IR. Three successive trials showed that left- and right-hemisphered mice displayed similar or different humoral IR, which indirectly indicates that their immune reactions to the same antigen are regulated by various mechanisms (Fig. 1). These results are consistent with published data that cerebral hemi-

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spheres in animals regulate IR by different mechanisms. It was shown that immunological parameters and the incidence and severity of autoimmune diseases in humans differ between left- and right-handers [6, 10]. However, the mechanisms of these differences remained unknown. Our findings suggest that differences in the intensity of IR between right- and left-hemisphered mice are significant, but irreproducible, and, therefore, some unknown factors can be involved in the regulation of IR in these animals.

Our previous studies demonstrated functional asymmetry of immune organs, *e. g.*, thymus, bone marrow, and lymph nodes [3-5]. We hypothesized that the relationship between the cerebral hemispheres and thymus lobes underlie the differences in humoral IR. To evaluate the role of functional asymmetry in the nervous and immune systems, thymectomized left- and right-hemisphered recipients received thymocytes from the left or right thymus lobe of left- or right-hemisphered donors.

Thymocytes from the left thymus lobe induced much more pronounced IR both in left- and right-hemisphered recipients compared to cells from the right thymus lobe (Fig. 2, *a*). These differences between thymocytes from the left and right thymus lobes indicate that the left thymus lobe in right-hemisphered animals contains immune-stimulating cells, which activate the immune system in recipients irrespective of the dominance of the right or left hemisphere.

Thymocytes from left-hemisphered mice produced other effects in thymectomized recipients. We found no differences in IR intensity between left- and right-hemisphered recipients receiving thymocytes from the left and right thymus lobes of left-hemisphered donors (Fig. 2, *b*). Thus, thymocytes from the right and left thymus lobes of left-hemisphered animals did not differ in their ability to regulate humoral IR.

The role of cells from various thymus lobes in IR was confirmed by repetitive experiments. Therefore, we revealed a factor, which (in addition to nervous system asymmetry) determines the intensity of humoral IR in left- and right-hemisphered animals.

These data indicate that the intensity of humoral IR significantly differs between left- and right-hemisphered animals. As differentiated from thymocytes of left-hemisphered mice, cells from the right and left thymus lobes of right-hemisphered animals produce different effects on the development of humoral IR. The dependence of functional asymmetry in the thymus on the dominance of the left or right cerebral hemisphere indicates the interrelation between nervous and immune system asymmetries. Thus, asymmetry in the nervous and immune systems plays an important role in the development of humoral IR.

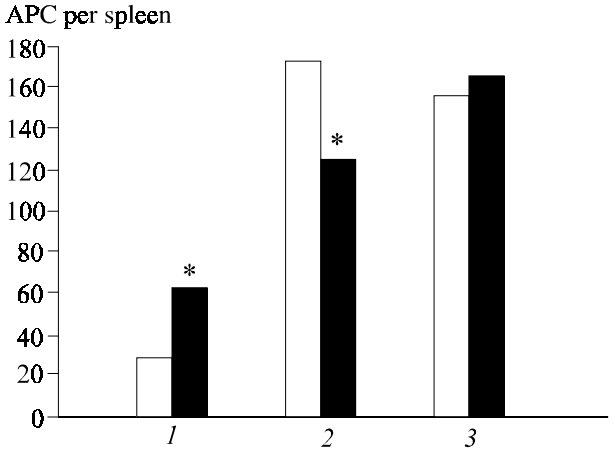

Fig. 1. Immune response to sheep erythrocytes in male (CBA× C57Bl/6)F_1 mice differing in forepaw preference: trials 1 (*1*), 2 (*2*), and 3 (*3*). Intensity of the immune response in right- (light bars) and left-hemisphered mice (dark bars). *$p<0.05$ compared to right-hemisphered animals.

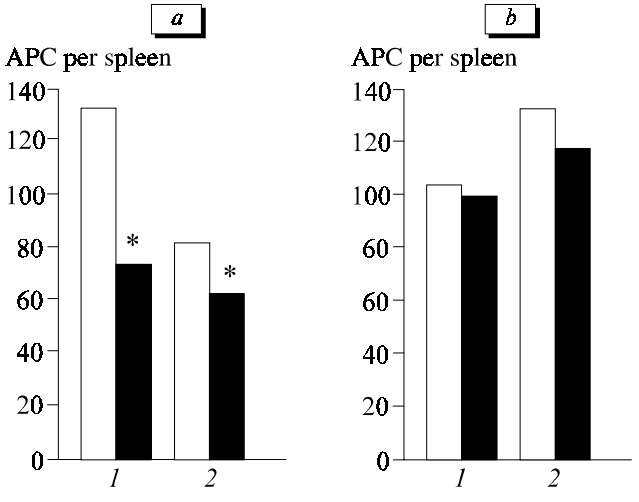

Fig. 2. Immune response to sheep erythrocytes in left- (*1*) and right-hemisphered thymectomized recipients (*2*) treated with thymocytes from the left (light bars) and right (dark bars) thymus lobes of right- (*a*) and left-hemisphered (*b*) donors. *$p<0.05$ compared to mice injected with thymocytes from the left thymus lobe.

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