Study of Immunogenic and Membranotropic Activities of Fullerene C60 Derivatives

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Study of immunogenic and membranotropic activities of fullerene C60 derivatives

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One of the promising opportunities is to use the fullerenes in medical applications such as nuclear medicine, drug and vaccine delivery, adjuvants and others. However, currently the immunology of fullerenes is an unexplored area, and considering a future application of fullerenes a key question raises - whether fullerene compounds are able to mount the C60-specific immune response as well as modulate/ induce allergic reactions? On the one hand, a possibility to prepare anti-60 antibodies is crucial important for analysis of fullerene derivatives in different media including biological, however, on the other hand, such immunogenic activity may be undesirable keeping in mind that the C60 compounds may provoke harmful immune reactions. Our earlier study showed the water- soluble amino acid derivatives of C60 were not able to produce C60- specific IgG response in lab rabbits and mice. To gain further clarity now we use other amino acid water-soluble 60 derivatives conjugated with proteins (ovalbumin, Ova, and bovine serum albumin, BSA) as well as pure C60 and hydrated C60 in form of colloidal dispersion in water (C60FWS) [1]. All these derivatives were studied for immunogenic activitiy in respect of production of C60-specific IgG. Mice (CBAxC57Bl/6)Fl were immunized with these compounds in complete Freund's adjuvant 4 times in 2 week intervals. To study a possible effect of C60 compounds on a behavior of well-known allergen Ova, the Ova-specific IgE producrion was assayed by passive cutaneous anaphylaxis when compared with immunization using OA alone.

As a principle result, we could not detect noticeable anti-C60 IgG/IgE- producing activities during immunization mice with C60 alone and its derivatives. However, some C60-derivatives showed adjuvant ability, enhancing the production of IgG antibodies when immunized with mixture of C60-amino acid or peptide with a protein antigen. We have found also that low-molecular C60-derivatives are able to cause a pronounced membrane permeabilization (dissipation of the Dy) of biological membranes with a dose-dependent kinetics. Other experiments with human erythrocytes showed that even in rather high concentration these C60-derivatives do not evoke their lysis and agglutination. Thus, the fullerenes do not possess an intrinsic immunogenicity and could be a promising basis for design of drug delivery systems. Supported in part by RFBR grant (00-04-48317a).

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