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ON THE QUESTION OF ANTIGENS

K.G. GARKAVA

National Aviation University, Kiev

The paper discusses the issues of increasing the antigen under the influence of negative factors of the environment and in obtaining biologically active compounds using recombinant techniques.

Keywords: *antigens, adducts, recombinant biologically active compounds.*

Introduction. The influence of negative environmental factors increases the spectrum of antigen (AG) unpredictability. Antigens are substances that carry genetic features of foreignness and when administered to the organism induce the development of immunological reactions: synthesis of antibodies, the cellular immune response, immune tolerance and immunological memory.

Antigens are classified into:

1. Complete antigens – organic substances of the complex chemical structure:

- proteins;
- polysaccharides;
- nucleoproteins;
- lipopolysaccharide.

2. Incomplete antigens (haptens) – simple organic substances, but in some cases with complex chemical structure. Inorganic substances.

- complex haptens (polysaccharides, polypeptides, lipids, nucleic acids);
- simple haptens (monosaccharides, simple organic and inorganic substances) [8, 9, 13].

Can enzymes be antigens? Works of Fedoriche V.N. 1988-2011 have shown that antibodies are produced to the enzymes lactate dehydrogenase, creatine phosphokinase, esterases and DNA-ase. He has shown that the dynamics of antibodies production to lactate dehydrogenase and esterase can help to trace the course of the small focal and macrofocal acute myocardial infarction and its outcome. Perhaps one of the factors reducing the activity of enzymes is their acquisition of antigen properties. It is known that the activity of fibrinolytic enzyme streptokinase is also reduced for the same reasonx [11, 12].

Antigens characteristics

Antigens are characterized by:

- foreignness – antigens are the carrier of genetically foreign information to the body;
- antigenicity – the ability to induce the production of antibodies. Proteins with the dextrorotatory isomer of the amino acids in the macrophage is not processed and do not include the transmission of antigenic information;
- immunogenicity – the ability to create the immunity;
- specificity – the antigenic characteristics by which antigens are different from each other.

Antigens – are macromolecular substances. Their valence depends on the molecular weight. Antigen valency is a quantity of determinant groups on an antigen molecule or number of antibody molecules, which can connect to them. For instance, egg albumin has a valence 5, serum albuminn – 6, thyroglobulin – 40.

Antigen properties depend on the stiffness of the structure and spatial configuration of their molecules. Stiffness of structure is given to antigenic determinant by three amino acid – tyrosine, tryptophan and phenylalanine.

The specificity of antigen – is the antigenic characteristics by which antigens are different from each other.

The are following types of antigen specificity:

- species specificity – is the specificity, in which members of one species of organisms differ from another species;

- group specificity – is the specificity, which causes the differences among individuals of the same species of organisms (blood group, histocompatibility antigens);
- type specificity – it often relates to the specificity of microbial species. Botulinum toxin synthesized in nature are divided into types A, B, C, D, E.
- organ or tissue specificity is proved to all organs and tissues;
- organoid specificity defines the antigenic differences of cell organelles (nucleus, ribosomes, mitochondria)
- hetero specificity – is common antigens for members of different species. For instance, Forsman antigen is present in erythrocytes of sheep, horses, dogs, cats, mice and chickens, but not in humans, monkeys, rabbits, rats or ducks;
- functional specificity – is related to the function of the protein molecule. For instance, human and bovine insulin perform the same function, but differ in one amino acid;
- stage specificity – is antigenic characteristics of organs and tissues, which are at certain stages of individual development and embryogenesis. For instance, α-fetoprotein is the antigen present in fetal liver but absent in the adult organism;
- hapten specificity – is due to the specificity of a hapten groups;
- pathological – is related to properties of antigens in organ and tissue with pathological changes.

All the antigen specificity is due to the active chemical group. The antigenicity of proteins is due to the primary and conformational structure of the molecule. Variation of the chemical composition and structure of the antigen molecule changes its specificity. Replacement of a single amino acid in the polypeptide chain changes an antigen (e.g., human or swine insulin). It is known that small changes of surface groups, for example, when NO_2 and J_2 are introduced into a protein molecule followed by methylation, acetylation and blockade of the surface carboxyl and other antigenic groups, it will change the antigen specificity. Iodization of proteins leads to a change in the species specificity.

Cross-reactive antigens

Cross-reactive antigens general, antigens of micro- and macro-organisms.

Cross-microbial antigens can induce the formation of autoantibodies in the mammalian organisms to their tissues.

Streptococcus of group A has cross-reactive antigens with cells of skeletal and smooth muscle of endocardium, heart valves and kidneys.

β-hemolytic streptococcus has similar antigens with connective tissue of heart muscle and blood vessels.

Lipopolysaccharide of *E. coli* strain 086 is similar to erythrocytic izoantigen B.

Nucleoproteins of streptococcus are similar to the nucleoprotein of the collagen.

Streptococcus and Staphylococcus have cross – reactive antigens with HLA-antigens [8, 9, 13]. Number of antigens in nature increases due to the fact that many not antigenic substances in connection with other materials become antigens.

Adducts

The adduct – is the result of the covalent attachment of one molecule to another. Some adducts cause permanent blocking or inhibiting of enzymes. Adducts with DNA may have mutagenic or carcinogenic properties. Many allergens are adducts known as haptens. The mechanisms of formation of adducts are very diverse – some are formed as result of the capture of free radicals, others – when nucleophilic and electrophilic substances are combined.

Natural adducts

Natural adducts can be formed during connection of chemically active groups of different nature with cells, proteins and nucleic acids. For example, aminopyrine, quinidine, phenolphthalein, picric acid, and toxic organophosphorus compounds, antibiotics, adsorbed on blood corpuscles, proteins and peptides may cause leukopenia, anemia and thrombocytopenia. These proteins induce production antibodies of 3 types:

1. Against the hapten determinant.
2. Against self determinants of the protein molecule.

3. Against those chemical modifications that occurred after the accession of the active chemical groups [9, 13].

Chemical adducts

Modification of proteins derived from polyethyleneglycol to impart stability and prolonging their action, solubility in organic solvents commonly used in biotechnology. Such protein adduct consists of two macromolecular fragments - the protein and polymer blends and the properties of each of them. As the polymer fragment using dextran. They are used for developing new dosage forms as vehicles for transport to the cells of the target substances insoluble in water. What antigens are formed on them? – The question remains opened [4, 10, 14].

Genetically modified organism

Genetically modified organism – is an organism, which has the alien gene introduced to it natural set of genes by genetic engineering methods.

Obtaining of recombinant α2-interferon

As a result of plasmid technology that is highly productive, but has a serious disadvantage: obtained interferon has a different oligomeric structures that are absent in natural interferon.

In contrast to the plasmid technology, synthesis of α2-recombinant interferon based on the use of bacteriophage as an amplifier, into the genome of which the gene of interferon is injected by genetic engineering method. Bacteriophage (virus of bacteria), infecting bacterial cell, multiplies in it by copying DNA and built-in it interferon gene, and synthesizes proteins, including interferon. At a certain stage of development bacteriophage lyses the bacterial cell. Interferon releases into a culture fluid in water-soluble state, without forming insoluble forms. Synthesis is organized in such way so that interferon accumulates extracellularly in the culture medium therefore does not constitute an "inclusion bodies", as occurs in plasmid technology of obtaining an interferon [1-3, 6].

A Question: how similar is a structure of natural and recombinant leukocyte inteferon – remains open, although they have similar functional activity.

Recombinant technology is also used to obtain insulin.

Question – how similar is antigenic structure of biologically active compounds of natural and recombinant origin remains open, although they are similar by functional activity.

The transgenic vaccines

Recombinant technology is used to produce vaccines against hepatitis B and Lyme disease [5-7].

The creation of DNA-vaccine is predominantly carried out with bacterial plasmids – small stable circular DNA which are located outside chromosomes. Plasmids themselves do not provoke infection. In fact they are only used as a vector, which is a delivery vehicle. To cause the required immune response, isolated from bacteria plasmid are modified introducing specific changes in the DNA structure sewing in genes encoding one or more specific protein antigens, which are produced by a specific bacterium or a virus. Also there are incorporation of genes required for the expression of the whole structure. At the same time, the DNA fragments which are responsible for the restoration and reproduction of infection, are not carried into the plasmid.

There is a risk that the foreign DNA can harm the human DNA, as well as there is an assumption that at this immunization the immune response against self antigens can develop and strengthen, ie autoimmune reaction, which can then move to self-aggression. Also the introduction of foreign DNA can cause mutations in the genome of an organism and change in ontogeny [15-18].

CONCLUSION

A wide range of natural and man-made antigens lead to either stimulation or inhibition of the immunological reaction, or generates tolerance.

- Inhibition leads to an increase in infectious diseases and cancer.
- Stimulation leads to the development of autoimmune diseases and autoaggression.
- Tolerance results in enhanced persistence of infectious agents.
- Increased antigenic stimulation enhances apoptosis of immunocompetent cells and leads to the deterioration of the immune system.

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ДО ПИТАННЯ ПРО АНТИГЕНИ

К.Г. ГАРКАВА

Національний авіаційний університет, м. Київ

В роботі розглянуті питання щодо збільшення антигенів під впливом негативних факторів навколишнього середовища та при отриманні біологічно активних сполук рекомбинантными технологиями.

***Ключові слова**: антигени, адукти, рекомбінантні біологічно активні сполуки.*

К ВОПРОСУ ОБ АНТИГЕНАХ

Е.Г. ГАРКАВАЯ

Национальный авиационный университет, г. Киев

В работе рассмотрены вопросы увеличения антигенов под влиянием негативных факторов окружающей среды и при получении биологически активных соединений рекомбинантными технологиями.

***Ключевые слова**: антигены, аддукты, рекомбинантные биологически активные соединения.*