

Adjuvants are vaccine additives which cause a stronger response of the immune system whereby a smaller amount of antigen can be used in the vaccine. Other components of vaccines, beside adjuvants, are previously mentioned antigen (for example an element derived from the surface of dangerous bacteria against which the vaccine was created), excipients and additives, eg. preservatives, stabilizers as well as remnants of the manufacturing process. The aim of the project is to create a new, safe adjuvant, which potentially can be used in vaccines administered intranasally. The effect of a vaccine that is applied into the nose is the production of antibodies in remote areas of the body such as intestinal surface. The presence of antibodies against harmful microorganism is essential for its eradication by the immune system. The use of intranasal vaccines has many advantages - no need to puncture the patient, the possibility of self-administration of the preparation at home or the increase the effectiveness of patient immunization through imitation of infection the natural way.

Developed in our laboratory adjuvants are in the form of fat droplets suspended in the water about the size of not more than 1 micron. Because of their size they are called nanoadjuvants. Nanoadjuvants are composed of oil, two types of detergents, organic solvent and water in appropriate proportions. Similar formulations in the form of nanoemulsions are already known to be stable, do not delaminate and in terms of strengthening the immune response act in two ways - are small depots of antigen which is released from them into the body in a slow way and have a specific action function that is immunoreactive to specific immune cells. Its immunoreactivity is based on the stimulation of a humoral (antibody production) and cellular immune system (cell activity) - such action has been found to be most effective. Based on the experience and knowledge from the literature we decided to create our own, improved formulations also based on the emulsion. They will be prepared with synthetic oil and a unique mixture of detergents. In the next step synthesized nanoadjuvants are going to be carefully characterized, their physical, chemical and biological properties will be described. We will study how they work and identify whether they are safe for human cells. Preliminary studies on similar formulations showed their very low cytotoxicity and high efficiency for example in combination with elements of influenza virus. This project is a 100% in the definition of basic research which does not exclude the practical application of nanoadjuvants in the future after some additional testing.

Our team decided to deal with this issue, because of the increasing risk of infections, particularly in the elderly. On the market there are no vaccine adjuvants tailored to the needs of this age group. The average life expectancy is increasing at a rapid pace, this is due to more and better hygiene conditions and better health care. Related to this, however, the effectiveness of the immune system in the elderly is reducing so that even these pathogens to which an individual has previously been resistant become dangerous. Moreover, the currently used adjuvants are suspected of causing a number of side effects in the form of local reactions such as pain and redness as well as system-wide effects such as fever and malaise. Vaccination involves significantly more side effects, however, it is usually very difficult to determine whether they come from adjuvant or another ingredient of the vaccine, or whether they arise from the wrong patient eligibility for vaccination by a doctor. The growing threat of bioterrorism and the need to find a way to quickly and efficiently vaccination is also not without significance. The adjuvants present in the market are not able to meet the challenges of the twenty-first century society. Preparation of adjuvant adapted to mucosal administration will allow to create cheap and easy to manufacture vaccine for multiple, self-administration.