The frequency of allergic diseases is increasing in our population and around the world. We are currently experiencing the phenomenon of "allergy epidemics". Forecasts suggest that in the next decade, over 300 million Europeans will suffer from one of allergic diseases. Allergies occur when the immune system interprets a harmless antigen (e.g. grass pollen) as a threat as serious as pathogen (e.g. bacteria) invasion. The central role during the process is played by so-called T lymphocytes, cells that can accurately identify an antigen and carry out a targeted response against it, resulting in a so-called “immune memory”. If the allergen is mistakenly recognized, these cells become hyper-responsive, which wind the spiral of inflammation and contributes to the production of antibodies against the allergen. Currently, a number of medications are available that make life easier for allergy sufferers by reducing the onerous symptoms that result from the inflammation. However, there is only one causative treatment that works by eliminating T-cell hypersensitivity to allergens, forcing them into a state of so-called tolerance, i.e. promoting lack of reactivity. It is so-called specific immunotherapy (desensitization). Despite the fact that immunotherapy is a chance for life without risk and everyday worries for many patients, often being able to "heal" the allergy sufferer, the desensitization process itself is very long and carrying risk of serious side effects.

Within this project we plan to develop a new nanoparticle-based method of supplying allergens during desensitisation protocol to allow targeted delivery of allergens to cells instructing T lymphocytes (dendritic cells). Such targeted supply aims to direct the reactivity of these cells in such a way as to produce the immunological tolerance as quickly and efficiently as possible. We plan to use house dust mite allergens as our model. This will enable us to determine the potential of constructed nanoparticles as a method to improve the process of desensitization to allergens during specific immunotherapy. Since the mite allergen is only an experimental model, the results obtained during the proposed studies will allow us to predict what immune responses we will be able to obtain also for a wider range of allergens. Our research into a new allergen administration strategy will help to propose more effective and safer methods of desensitizing allergy patients.