

Allergy to birch pollen is increasingly spreading among Europeans and even 16% of the Polish population is showing its symptoms. Moreover, in this kind allergy patients there is a cross reaction resulting in an increased immune response to related tree species and food allergy to certain vegetables and fruits. Until now, it has not been possible to develop a drug that would not only reduce the effects of the disease but also treat it. The first step towards the treatment of pollen allergy is to create an appropriate model for its testing. The use of the mouse model in this case is not effective due to the different nasal cavity structure of humans and mice and the lack of natural allergy in these animals. In addition, the mouse model is not suitable for testing a large number of samples due to ethical and financial constraints. In conclusion, the use of human nasal epithelial cell line is the optimal solution. The nasal epithelium is the first place of contact between the body and the allergen, and it is the site of the occurrence of the first allergy symptoms. **In my research, I want to focus on the characteristics of two cell lines and the assessment of their use as models in pollen allergy studies. In addition, using these models, I will examine the potential antiallergic effect of probiotic *Bifidobacterium* strains.** Recent research shows that probiotic *Bifidobacterium* strains have unique immunomodulatory properties and are able to support both prevention and treatment of allergies. There are no comprehensive studies on *Bifidobacterium* strains in the context of pollen allergies. However, it is suggested that delivering bacteria directly to the site of inflammation (nose) may allow a faster and more effective response to treatment than taking probiotics orally. All the studies planned in the project are in the field of basic research, in which simple dependencies and mechanisms taking place at the cellular level will be examined, the next stages of work will show the relationships occurring in more complex systems.

The proposed project will include the development of a protocol for the cultivation of two cell lines - human nasal epithelial cell line and the primary human nasal epithelial cells. Both lines will be characterized in terms of their usefulness in studies of pollen allergy mechanisms. The tests that will be used are: measuring the electrical resistance (TEER), microscopic imaging and 3D culture technology. Next, experiments will be carried out using birch pollen and pro-inflammatory ligands, which aim to induce inflammation in both of these lines. After selecting the appropriate conditions and concentrations, the influence of two live *Bifidobacterium* probiotic strains (*B. adolescentis* 373 and *B. longum* 367) and the components released by these bacteria to the environment will be examined. The control will use a steroid with confirmed anti-inflammatory effect used in inhibiting allergies. *Bifidobacterium* strains will also be tested for prophylactic properties against allergies. During the experiments, the concentration of pro- and anti-inflammatory cytokines will be measured on an ongoing basis. For selected conditions, gene expression of tight junctions proteins such as zcludin and occludin responsible for maintaining membrane integrity using PCR will be investigated. The results will be complemented by the study of the expression of above proteins isolated from epithelial cells and determination of their concentrations using Western blotting.

This research will be a source of new knowledge mainly in the field of immunobiology but also in microbiology. **The effect of the proposed works will be a detailed characterization of the nasal primary and immortalized epithelial cell lines. The allergic effect of birch pollen on both lines and the potential antiallergic effect of two *Bifidobacterium* strains will be tested.** The results will include cytokine profiles, the expression of genes and proteins involved in the formation of inflammation as well as its silencing. The results will be published in recognized scientific magazines in the field of immunology and will be presented at international conferences.