

Title: Alternation of allergenic properties of pollen grains during its emission, atmospheric transport, and deposition.

Life of wind-borne pollen is not easy. After release from the flowers into the atmosphere pollen grains have to face very severe conditions, e.g., extreme temperature, solar radiation, and varying humidity. Such conditions may markedly affect morphological and physiological features of pollen, including its ability to produce, maintain, and release allergens (so called pollen allergenicity). The impact of atmospheric processes on the allergenic properties of pollen is however an enigma. In fact, it is not known how long pollen grains can maintain allergenicity, so, practically, for how long the pollen can induce an allergy reaction. Therefore, the main goal of this proposal is to thoroughly explain the phenomenon of allergenicity transformation of pollen during its whole cycle in the atmosphere, from pollen release, through transport in the air, and ending on pollen deposition on the ground.

We aim to expose allergenic pollen of *Betula pendula* (silver birch - tree), *Phleum pratense* (timothy – grass) and *Artemisia vulgaris* (mugwort – weed) i.e., the most allergenic species in Central Europe, to the conditions characteristic for both local and global transport in the atmosphere, taking into account the variation in temperature, humidity, and UV-radiation. Experiments will be conducted in the field and in laboratory conditions (using climatic chamber, solar simulator – special device that simulates conditions in the atmosphere). Allergenic potential of pollen will be expressed by: 1) the amount of major pollen allergen 2) total protein content and composition, 3) level of transcripts coding pollen allergens (so, on the nucleic acids level). Finally, the changes in pollen viability, ability to germinate (i.e. produce pollen tube), and morphology will also be evaluate.

Many plants are considered important causes of allergy reactions, and it has been estimated that about 20–25% of the population suffers from pollen allergy. Pollen grains are carriers of numerous proteins, including many important allergens. Any transformation in the pollen allergenicity during pollen transport may therefore be crucial in its ability of causing allergy reactions. For instance, currently, it is not really known, whether pollen grains that have been released at morning are still as allergenic during the night. Can allergic people sleep with the open windows or not? Can they do jogging in the evening, or can they mow laws after the grass flowering season? These are just a few questions that our project intends to answer and that can improve the quality of life of allergic people. The results of this project may also provide data that could improve current pollen forecasts and atmospheric pollen transport models, as these models assumed that pollen is an unchangeable particle, i.e., it does not change its allergenic properties over time and is not affected by transport conditions. As we aim to estimate the effect of transport time and conditions on the level of allergens in pollen, thus we may equip pollen forecasts with an important variable, i.e. change rate in pollen allergenicity.

Successful achievement of the project objectives will result in a better understanding of the connection between pollen, environment, and human health. We believe that the project will provide many valuable quantitative and qualitative data about allergen and proteins composition in pollen that are still rare. Moreover, by determining the linkage between allergen transformation and weather conditions, these results may bring important hints about the impact of climate change on the future changes in exposure to pollen. Therefore, the results of this project will have some applications in clinical practice, e.g., in the prediction and prevention of allergic diseases, and practical applications regarding the improvement of current pollen forecasts. Finally, at the end of the project, it is expected that there will be a much stronger network between project partners, that should be a driving force for the emergence of new ideas in a fields of atmospheric science, aerobiology and air quality research.