**The influence of antimicrobial photoinactivation on virulence of *Staphylococcus aureus* strains colonizing atopic dermatitis patients: *in vitro* and *in vivo* studies.**

Atopic dermatitis (AD) is a common disease, affecting about 5-20% of children around the world. In adults, it is less common and affects approximately 1-3% of the population. This disease significantly reduces the quality of life of patients and their families due to clinical manifestation and symptoms. AD is a chronic, recurrent and inflammatory disease that occurs with pruritus. The disease develops as a result of the interaction of genetic and environmental factors. The skin of the vast majority of patients with AD, both atopic and healthy, is colonized with *Staphylococcus aureus*, which produces numerous virulence factors, i.e. toxins that help bacteria penetrate and spread in human tissues. Staphylococcal virulence factors contribute significantly to exacerbating skin inflammation in patients with AD. Topical treatment with glucocorticosteroids is first-line therapy in AD. The treatment also employs calcineurin inhibitors, ultraviolet light phototherapy, and in the case of secondary bacterial infections, antibiotics. Due to the rapidly growing antibiotic resistance of microorganisms, dermatologists do not recommend the use of antibiotics in the treatment of AD. Hence the need to look for methods that would complement existing therapeutic options. Therefore, we will examine the possibility of using the photodynamic method in killing *S. aureus* cells occurring in patients with AD. Photoinactivation involves the action of light-activated compounds and safe visible light. In contrast to UV light, which has mutagenic properties. We will check whether, as a result of the photodynamic method, we can also destroy the virulence factors produced by these strains in addition to killing the bacterial cells themselves. Our hypothesis assumes that killing *S. aureus* cells as well as virulence factors produced by them is possible while maintaining safety towards host cells. As a part of the proposed project, we examine the most common virulence factors i.e. staphylococcal enterotoxins: SEA, SEB, SEC, SED and TSST-1. We will detect the presence of genes encoding such factors and check if they are produced. Next, we will develop the most effective photoinactivation conditions with respect to the tested strains and the toxins secreted by them. For this purpose we will use classic molecular biology methods. Application of the mouse model of atopic skin, will verify the effectiveness of the photoinactivation protocol developed. Currently, we know that by using photoinactivation we can destroy microorganisms that are resistant to antibiotics. This is valuable due to the fact that using an alternatives as regards antibiotics will allow to limit the use of the latter, and will contribute in the long term to the elimination of the growing trend of microbial resistance. In this sense, the proposed project is in line with the strategy advocated by global institutions such as the World Health Organization (WHO). The research results obtained as a part of the proposed project will contribute on the one hand to explaining the mechanisms of photoinactivation of microorganisms at the basic level, on the other hand they will be a starting point for further research on the possibility of using this method as an effective strategy for combating multi-resistant microorganisms.