Parkinson's Disease is a neurodegenerative disorder, which affects about 2 % of the population after the age of 60. It is characterized mainly by motor system disorders and is manifested mainly through bradykinesia, tremor muscular rigidity, and loss of coordination. The hallmark of the disease is associated with the appearance of Lewy bodies – pathological structures which develop inside nerve cells. Studies on the composition of the Levy bodies have shown that they contain mainly α-synuclein – protein, which is physiologically abundant in the brain, while smaller amounts are found in the heart, muscle, and other tissues. It has been also identified that accumulated α-synuclein in Levy bodies occurs in misfolded forms and can be a cause of neuronal death.

It has been shown by using various biophysical techniques that perturbation of long-range interactions between regions of α-synuclein may be the cause of improper folding of the protein structure. One of the factors which can affect the interactions is adsorption on a solid surface – the process of adherence of particles to the surface which in this case is driven by interactions between α-synuclein and surface. Also, changes in the distribution of charge on the protein surface can cause changes in the structure of the protein leading to the development of pathological forms. Although a lot of studies on α-synuclein have been conducted and many ambiguities have already been clarified there are still questions remain unanswered regarding its structure and toxicity. The aim of the project is to examine the effects of the process of adsorption of α-synuclein onto a solid surface on α-synuclein structure. Therefore, in this project, it is proposed to determine if adsorption can have a significant effect on the development of toxic structures of α-synuclein. What is more, as we know that the distribution of the charge on the surface of α-synuclein can be of great importance for changes in its secondary structure, it is proposed to examine the effect of the adsorption process under the influence of the applied electric potential on the structure of the protein.

The results of the presented project will introduce new conclusions about the effects of molecular interactions of unordered proteins with the gold surface on protein structure and effectiveness of protein deposition on such surface. The research has also the potential to affect the explanation of the folding mechanism in the direction of toxic aggregates and fibril formation present in neurodegenerative diseases. Successful characterization of changes that occur during the adsorption process will significantly enhance the ability to therapeutically target these processes and mitigate neurodegenerative diseases. This knowledge is especially important given that there are few, if any, pharmacological targets that modulate the symptoms of most neurodegenerative diseases.